Development of oral health interventions for inter-professional management of diabetes

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Abstract

Background

Periodontitis impairs glycaemic control in people with diabetes and diabetes is a major risk factor for periodontitis. Cochrane reviews have reported HbA1c reductions of up to 4 mmol/mol following treatment of periodontitis, yet many clinicians and patients with diabetes are unaware of this.

Aims/objectives

To develop oral health interventions for delivery in primary medical care and to explore inter-professional communication in the context of management of diabetes and periodontitis.

Methods

The behaviours of medical and dental practitioners in relation to published diabetes and periodontitis best practice recommendations were surveyed using theoretically designed online questionnaires to assess predictors and determinants. The questionnaires were designed using a novel combination of social cognitive theory and normalisation process theory. The survey findings were discussed in iterations of workshops with patients, and medical and dental professionals to develop and pilot interventions in primary medical care for feasibility and acceptability.

Results

The self-reported survey findings showed that medical and dental professionals had limited knowledge of best practice recommendations; however, the importance of improved communication to enhance patient care was valued. Clinicians from both professions expressed a preference for indirect referrals, though a case study revealed negative consequences following this approach. Through workshop development, oral health interventions to inform patients about the bidirectional relationship between diabetes and periodontitis and advise those without a dentist to attend for periodontitis assessment and treatment were designed and subsequently experienced as feasible and acceptable by nurses.

Conclusions

Best practice recommendations to improve the uptake of evidence-based care in the context of diabetes and periodontitis are not widely known and inter-professional communication is problematic. Nurses have an important role in the delivery of oral health interventions and future research should evaluate these interventions formally.

Dedication

This thesis is dedicated to Jack and Amy Bissett. Do not let school or early challenges define who you are. Believe in yourself and set your goals high. There is much to be gained by hard work and determination at any time in your life.

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Firstly, I wish to thank my supervisors for their time, expertise and their continued support. Professors Tim Rapley and Philip Preshaw gave me the confidence to believe that I could aspire to studying for a PhD, something which is atypical for dental hygienists. Dr Justin Presseau agreed to join us in putting together an application for an NIHR Doctoral Research Fellowship (DRF). Thanks to all the guidance from my supervisors, I was successful (the first dental hygienist to be awarded an NIHR DRF) and the last four years have been an incredible journey. I am very grateful to Dr Presseau and Elaine Stamp for their statistical support; to Dr Presseau for staying with the project despite leaving Newcastle University and relocating to his native Canada; and to Professor Rapley for continuing to see the project through to the end, despite also leaving Newcastle University.

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Table of Contents

Abstract ……i

Dedication……..ii

Acknowledgments ……iii

Table of Contents ……..iv

List of Tables …… xi

List of Figures ……...xiv

List of Abbreviations …… xv

Chapter 1 Prologue …… 1

1.1 The emergence of the dental profession ……... 2

1.2 The case for inter-professional working in medicine and dentistry……...2

1.3 The research problem……3

1.4 The research aim……3

1.5 The composition of the thesis…… 4

Chapter 2 Introduction to Diabetes and Periodontitis ……... 5

2.1 Diabetes (mellitus) …… 6

2.1.1 Diabetes definition …… 6

2.1.2 Diabetes diagnosis …… 7

2.1.3 Diabetes classification …….. 9

2.1.4 Epidemiology of diabetes …… 10

2.1.5 Treatment of diabetes ……11

2.2 Managing long term chronic conditions ……... 11

2.2.1 Acceptance of chronic care models …….. 13

2.3 Diabetes management in primary medical care …… 14

2.4 Periodontitis …….. 16

2.4.1 Periodontitis definition ……..16

2.4.2 Periodontitis diagnosis ……..17

2.4.3 Periodontitis classification ……18

2.4.4 Epidemiology of periodontitis …….. 21

2.4.5 Treatment of periodontitis …… 21

2.5 Periodontal treatment in primary dental care ……... 22

2.6 Summary ……...24

Chapter 3 Oral-systemic connection and a case for intervention ……..25

3.1 Diabetes and periodontitis – a bidirectional relationship …… 26

3.1.1 Recommendations for a multidisciplinary approach to patient care in the context of diabetes and periodontitis ……... 28

3.2 The case for inter-professional working in the context of diabetes and periodontitis ……... 32

3.3 Diabetes and periodontal management in USA – a case study..……... 33

3.3.1 Organisation of care ……..34

3.3.2 Drivers of change ……..37

3.3.3 Relevance of USA case study to UK management of diabetes …… 39

3.4 Intervention development and evaluation model ……..39

3.5 Implementation theories ……..……...40

3.5.1 Early theories of human behaviour and learning ……..41

3.5.2 Classic theories – social cognition models to identify determinants of action ……..……... 42

3.5.3 Determinant framework and implementation theories ……. 44

3.6 Novel combination of SCT and NPT……46

3.7 Summary……47

Chapter 4 Identifying behavioural and organisational correlates of primary care medical professional clinical behaviours in the context of diabetes and periodontitis ……49

4.1 Background ……...50

4.2 Methods …… 50

4.2.1 Study design ……..50

4.2.2 Recruitment and data collection ……51

4.2.3 Measures ……... 51

4.2.4 Statistical analyses …… 54

4.2.5 Qualitative analyses……... 56

4.2.6 Regulatory Approvals…… 56

4.3 Results …….. 56

4.3.1 Descriptive analyses of past behaviour, SCT constructs and NPT items …. 59

4.3.2 Correlates of past behaviour and SCT constructs ……67

4.3.3 Binary logistic regression analysis of past behaviour and SCT constructs …….. 69

4.3.4 Who could/who should, carry out the behaviours?……72

4.3.5 Timing of the behaviours ……...75

4.3.6 Qualitative data from free text fields …… 76

4.4 Discussion ……79

4.4.1 Implications based on SCT findings ……80

4.4.2 Implications based on NPT findings ……80

4.4.3 Combining insight from SCT and NPT to inform intervention design …… 81

4.4.4 Strengths and weaknesses ……82

4.5 Conclusion …… 83

Chapter 5 Identifying behavioural and organisational correlates of primary care dental professional clinical behaviours in the context of diabetes and periodontitis …… 85

5.1 Background ……...86

5.2 Methods …… 86

5.2.1 Study design ……..86

5.2.2 Measures…… 87

5.2.3 Recruitment and data collection ……88
5.2.4 Statistical analyses …… 89
5.2.5 Qualitative analyses……... 90
5.2.6 Regulatory approvals …… 90
5.3 Results …….. 90
5.3.1 Descriptive analyses of past behaviour, SCT constructs and NPT items …. 93
5.3.2 Correlates of past behaviour and SCT constructs ……106
5.3.3 Binary logistic regression analysis of past behaviour and SCT constructs... 108
5.3.4 Who could/who should, carry out the behaviours …… 111
5.3.5 Timing of the behaviours ……... 117
5.3.6 Qualitative data from free text fields …… 119
5.4 Discussion ……122
5.4.1 Strengths and weaknesses ……125
5.5 Conclusion …… 126
Chapter 6 Oral health intervention development ……...127
6.1 Background ……... 128
6.2 Methods …… 129
6.2.1 Delivery of workshops ……..129
6.2.2 Recruitment and data collection…….……130
6.2.3 Reflexivity statement …….……131
6.2.4 Data analysis ……131
6.2.5 Regulatory approvals …… 131
6.3 Results ……...132
6.3.1 Development of oral health interventions to be delivered in a medical context…….. 132
6.3.2 Iterations of workshops …….…….... 134
6.3.3 Broad themes emerging from the analysis ……... 137

6.3.4 The feasibility and acceptability issues of each intervention mapped to the four constructs of NPT…….. 145

6.4 Discussion ……147

6.4.1 Strengths and weaknesses ……154

6.5 Conclusion …… 155

Chapter 7 Trial and qualitative evaluation of feasibility and acceptability of oral health interventions in a medical context……..157

7.1 Methods ……159

7.1.1 Recruitment ……...159

7.1.2 Data collection and analysis ……..…….... 159

7.1.3 Regulatory approvals …… 160

7.2 Results ……...160

7.2.1 'Discuss and refer to a GDP' intervention evaluation…..…… 163

7.2.2 'Discuss and refer to a DHT team member' intervention evaluation…… 164

7.2.3 Patient with periodontitis advised by their GDP to go to their GP for a diabetes assessment: experience of indirect referral……. 168

7.2.4 DHT focus group: experiences of delivering periodontal management…… 170

7.2.5 The results of the feasibility and acceptability of the interventions and indirect referral of the patient with suspected diabetes from the GDP to the GP mapped to NPT…….. 179

7.3 Discussion ……182

7.3.1 Strengths and weaknesses ……186

7.4 Conclusion …… 187

Chapter 8 Discussion……..189

8.1 Overview……190

8.2 Key findings……...191

8.2.1 The survey work…… 191

8.2.2 Oral health intervention development……193

8.2.3 Pilot trial of interventions for feasibility and acceptability in primary medical care……195

8.2.4 Indirect referral…….. 196

8.2.5 Access to NHS periodontal treatment……196

8.3 Inter-professional working…….197

8.4 Strengths and weaknesses……..200

8.4.1 The survey work……..... 200

8.4.2 Oral health intervention development……201

8.4.3 Pilot trial and evaluation of oral health interventions for feasibility and acceptability in a medical context……..202

8.5 Impact of research to date……..202

8.5.1 Advisor to NHS England for commissioning standard……. 202

8.5.2 Ardens healthcare informatics diabetes template…….. 203

8.5.3 Publication……. 203

8.6 Proposals for future research …… 203

8.6.1 Indirect referrals for suspected diabetes…… 203

8.6.2 Access to periodontal management under NHS provision…… 205

8.6.3 Dental professionals' use of guidelines……. 205

8.7 Conclusion……. 205

Appendices ……207

Appendix 1 Department of Health template GP letter ……. 208

Appendix 2 NICE PH38 diabetes risk score questionnaire ……..……209

Appendix 3 NICE PH38 template GP letter ……210

Appendix 4 Dental Cross Disciplinary Index (DXDI) – original version ……211

Appendix 5 Dental Cross Disciplinary Index (DXDI) – current version ……212

Appendix 6 Medical professionals' questionnaire ……... 213

Appendix 7 Primary medical care practice information sheet ……..219

Appendix 8 Dental professionals' questionnaire ……..221

Appendix 9 Workshop schedule……... 230

Appendix 10 Powerpoint slides of oral health interventions ……..232

Appendix 11 Diabetes Research and Wellness Foundation leaflet on periodontal disease and diabetes ……... 234

Appendix 12 Ardens diabetes template oral care section – current version ……...240

Appendix 13 Scottish Dental Clinical Effectiveness Programme (SDCEP) leaflet on diabetes and oral health ……... 241

Appendix 14 NICE PH38 diabetes risk score questionnaire guidance (selected pages) … 245

Appendix 15 *British Dental Journal* paper accepted for publication …….....253

References ……275

List of Tables

Table 3.1 Guidance and recommendations for the management of patients with periodontitis and diabetes…….. 30

Table 3.2 Five categories of theoretical approaches adapted from Nilsen.…….... 41

Table 4.1 Definitions of SCT and NPT constructs…….……... 53

Table 4.2 Five NPT items utilised in the survey work…….. 54

Table 4.3 Practice and sample level characteristics: descriptive statistics of medical professional survey data ……..58

Table 4.4 Descriptive statistics for informing patients about the links between diabetes and periodontitis ……. 60

Table 4.5 Self-efficacy items for informing patients about the links between diabetes and periodontitis, ranked lowest to highest …… 61

Table 4.6 Descriptive statistics for suggesting patients with poorly controlled diabetes go for a dental check-up ……. 64

Table 4.7 Self-efficacy items for suggesting patients with poorly controlled diabetes go for a dental check-up, ranked lowest to highest …… 65

Table 4.8 SCT correlates for informing patients about the links between diabetes and periodontitis …….. 68

Table 4.9 SCT correlates for suggesting patients with poorly controlled diabetes go for a dental check-up ……... 68

Table 4.10 Multivariate logistic regression model predicting past informing patients with diabetes about the links between diabetes and periodontitis …… 70

Table 4.11 Multivariate logistic regression model predicting past suggesting patients with poorly controlled diabetes go for a dental check-up ……71

Table 4.12 Who could/should inform the patient about the links between diabetes and periodontitis? ……..73

Table 4.13 Who could/should suggest patients with poorly controlled diabetes go for a dental check-up? ……...74

Table 4.14 Frequency statistics for timing options for the behaviours: ‘when is it a good time to…’ ……75

Table 5.1 Sample characteristics: descriptive statistics of dental survey data 92

Table 5.2 Descriptive statistics for informing patients about the links between diabetes and periodontitis 94

Table 5.3 Self-efficacy items for informing patients about the links between diabetes and periodontitis, ranked lowest to highest 95

Table 5.4 Descriptive statistics for considering the impact of periodontal treatment on glycaemic control and periodontitis 99

Table 5.5 Self-efficacy items for considering the impact of periodontal treatment on glycaemic control, ranked lowest to highest 100

Table 5.6 Descriptive statistics for contacting the patient's GP with regard to periodontitis and poorly controlled diabetes 103

Table 5.7 Self-efficacy items for contacting the patient's GP with regard to periodontitis and poorly controlled diabetes: ranked lowest to highest 104

Table 5.8 SCT correlates for informing patients about the links between diabetes and periodontitis 106

Table 5.9 SCT correlates for considering the impact of periodontal treatment on glycaemic control 107

Table 5.10 SCT correlates for contacting the patient's GP with regard to periodontitis and poorly controlled diabetes 107

Table 5.11 Multivariate logistic regression model predicting past informing patients with diabetes about the links between diabetes and periodontitis 109

Table 5.12 Multivariate logistic regression model predicting past considering the impact of periodontal treatment on glycaemic control 110

Table 5.13 Multivariate logistic regression predicting past contacting the patient's GP with regard to periodontitis and poorly controlled diabetes 111

Table 5.14 Who could/should inform the patient about the links between diabetes and periodontitis? 113

Table 5.15 Who could/should consider the impact of periodontal treatment on glycaemic control? 114

Table 5.16 Who could/should contact the patient's GP with regard to periodontitis and poorly controlled diabetes? 116

Table 5.17 Frequency statistics for timing options for the behaviours: 'when is it a good time to…' 118

Table 6.1 Intervention vignettes informing workshop discussion..... 133

Table 6.2 Primary care dental professional workshop recruitment 136

Table 6.3 Primary care medical professional workshop recruitment ……136

Table 6.4 Patient/carer/public workshop recruitment ……...137

Table 6.5 The four constructs of NPT mapped against workshop participants and interventions…….....146

Table 6.6 ‘Discuss and refer to a GDP’ described in TIDieR format……149

Table 6.7 ‘Discuss and refer to a DHT team member’ described in TIDieR format…….150

Table 7.1 Characteristics of the medical practices recruited …… 161

Table 7.2 Characteristics of patients who received interventions ……..162

Table 7.3 Characteristics of DHTs delivering periodontal management ……..…162

Table 7.4 Results of healthcare professional interviews and focus group mapped to NPT constructs ……180

Table 7.5 Results of patient interviews mapped to NPT constructs ……. 181

Table 8.1 Example of key references that could be incorporated into a template GP letter for the referral of a patient with periodontitis and suspected diabetes……..204

List of Figures

Figure 3.1 Key elements of the development and evaluation of complex interventions……...40

Figure 3.2 Social cognitive theory model showing associations between constructs and behaviour adapted from Bandura…….……...44

Figure 3.3 NPT framework, used to identify, conceptualize and evaluate the factors that promote or inhibit introduction, implementation and embedding of processes into normal care…….....……. 46

Figure 6.1 Overview of data sources and iterations of workshops ……...……. 135

List of Abbreviations

AAP	American Academy of Periodontology
ADA	American Diabetes Association
AGE	Advanced Glycation End-products
BDA	British Dental Association
BMI	Body Mass Index
BPE	Basic Periodontal Examination
BSDHT	British Society of Dental Hygiene and Therapy
BSP	British Society of Periodontology
CCGs	Clinical Commissioning Groups
CDC	Center for Diseases Control and Prevention
CKS	Clinical Knowledge Summaries
CPITN	Community Periodontal Index of Treatment Needs
CRN	Clinical Research Network
DAFNE	Dose Adjustment For Normal Eating
DAWN	Diabetes Attitudes Wishes and Needs
DCCT	Diabetes Control and Complications Trial
DESMOND	Diabetes Education and Self-Management for Ongoing and Newly Diagnosed
DHT	Dental Hygienist/Therapist
DoH	Department of Health
DRF	Doctoral Research Fellowship
DSN	Diabetes Specialist Nurse
DXDI	Diabetes Cross Disciplinary Index
EFP	European Federation of Periodontology
FDI	Federation Dentaire Internationale (or World Dental Federation)
GDC	General Dental Council
GDP	General Dental Practitioner
GP	General Practitioner
GPwSI	GP with special interest
HbA1c	Glycated haemoglobin (non-fasting) measure
HCA	Healthcare Assistant
HCP	Healthcare Professional

IDF	International Diabetes Federation
IFCC	International Federation of Clinical Chemistry
IGT	Impaired Glucose Tolerance
IQR	Interquartile Range
IL	Interleukin
IT	Information Technology
MDT	Multidisciplinary Team
MRC	Medical Research Council
n	Number
NENC	North East and North Cumbria
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
NICE PH38	National Institute for Health and Care Excellence Public Health guidance 38
NIHR	National Institute for Health Research
NP	Nurse Practitioner
NPT	Normalisation Process Theory
OGTT	Oral Glucose Tolerance Test
OHI	Oral Hygiene Instruction
OPG	Osteoprotegerin
PHE	Public Health England
PN	Practice Nurse
QOF	Quality Outcome Framework
R&D	Research and development
RAGE	Receptor for Advanced Glycation End-products
RANKL	Receptor Activator of NF-κB Ligand
RCT	Randomised Controlled Trial
REC	Research Ethics Committee
RSI	Root Surface Instrumentation
SCT	Social Cognitive Theory
SIGN	Scottish Intercollegiate Guidelines Network
SWP	South West Peninsula
TACT-A	Target, Action, Context, Time - Actor
TDF	Theoretical Domains Framework
TIDieR	Template for Intervention Description and Replication

TNF-α	Tumour Necrosis Factor-alpha
TPB	Theory of Planned Behaviour
UDA	Unit of Dental Activity
UK	United Kingdom
US	United States
USA	United States of America
WDI	Western Diabetes Institute
WHO	World Health Organisation

Chapter 1

Chapter 1: Prologue

This chapter provides the context for the body of work that is contained within the thesis. It states the research problem and the aims of this research. Furthermore it describes the organisation of the thesis to aid with navigation. This research was funded by the National Institute for Health Research (NIHR) through their Doctoral Research Fellowship (DRF) programme (reference number DRF-2014-07-023). The research team consists of myself and three supervisors: Professor Philip Preshaw, Professor of Periodontology; Professor Tim Rapley, Professor of Applied Health Care Research at Northumbria University; and Dr Justin Presseau, Assistant Professor at Ottawa University and Scientist at the Centre for Implementation Research, Ottawa Hospital Research Institute, Canada.

1.1 The emergence of the dental profession

In the middle ages, those suffering dental pain sought the services of the local barber-surgeon. This person was employed to tend to war wounded soldiers by performing minor surgical operations, in addition to cutting hair and trimming beards; and these skills extended to extracting teeth. In time, barber-surgeons demanded that their skills be recognised and a parliamentary appeal was made to recognise dental surgery as a legitimate branch of medicine. This resulted in the opening of the London School of Dental Surgery (1859) and the first Dentists Act (1878) which created a dental register. The British Dental Association (BDA) was founded to uphold the register (Bennett 1930) and dentistry emerged as a protected profession when the 1921 Dentists Act proscribed unregistered practice. In subsequent years, improving knowledge of the epidemiology and pathogenesis of oral and dental diseases together with the development of dental technologies resulted in changes in dental treatments, with a shift away from extractions to the restoration of teeth and the prevention of dental diseases, embedding oral and dental hygiene procedures into routinised practices of the population (Nettleton 1988).

1.2 The case for inter-professional working in medicine and dentistry

Since the mid-twentieth century, dental health has been the domain of general dental practitioners (GDPs) and other dental professionals and separate from, although closely related to, general health (Adams 1999, Davis 1980). This separation has remained largely unchallenged by medical and dental professionals, however, the role of dental health in systemic health is significant and perhaps, at times overlooked. Notwithstanding the contribution of oral health to quality of life (Allen *et al.* 2008, O'Dowd *et al.* 2010), oral

health impacts on systemic disease including diabetes and cardiovascular disease (Montebugnoli *et al.* 2005, Saito *et al.* 2004, Saremi *et al.* 2005). In 2013, the European Federation of Periodontology (EFP) and American Academy of Periodontology (AAP) held a joint workshop to review the evidence linking periodontitis to various systemic diseases. The workshop focused particularly on links between periodontitis and diabetes, cardiovascular diseases and adverse pregnancy outcomes, but also reviewed evidence linking periodontitis and conditions such as pneumonia, chronic kidney disease, rheumatoid arthritis, obesity, and metabolic syndrome (Linden *et al.* 2013). A consistent message from the various publications that resulted from the workshop was that more research is needed to investigate links between periodontitis and systemic diseases, and to improve collaborative working between the medical and dental professions for better patient care.

1.3 The research problem

Periodontitis was first referred to as a complication of diabetes in the early 1990s (Löe 1993) and evidence supporting both a bidirectional relationship and the potential to improve glycaemic control through the treatment of periodontitis, was to emerge some years later (Preshaw *et al.* 2012, Simpson *et al.* 2010, Simpson *et al.* 2015). These facts are generally not known by most people with diabetes or by the medical teams who care for them. We also know that patients with diabetes would like to be informed about all the complications associated with their diabetes and have consistent messages from all their healthcare professionals (HCPs) (Allen *et al.* 2008, Bissett *et al.* 2013). Furthermore, there is evidence to suggest that oral health is not a priority for people with diabetes and as a result they tend to have lower dental attendance than the average population (Allen *et al.* 2008, Kelly *et al.* 2000, Tomar and Lester 2000). Currently, the academic and organisational silos in which dental and medical healthcare teams operate would appear to hinder shared knowledge and effective joint management of the two conditions; and as knowledge alone is not sufficient to enable the delivery of healthcare interventions (Larme and Pugh 2001), research to identify the investment potential of medical professionals and enablers of change to aid implementation would be valued.

1.4 The research aim

The overall aim of this research was to develop and evaluate oral health interventions to improve the inter-professional management of periodontal health as part of overall diabetes management in primary care. The research was conducted in three phases. Phase one involved information gathering, exploring medical and dental professional clinical behaviours in the

context of diabetes and periodontitis. Phase two aimed to co-design and develop oral health interventions that could improve primary care medical clinician communication with patients regarding the links between diabetes and periodontitis. Phase three aimed to trial the candidate interventions in primary medical care for feasibility and acceptability.

1.5 The composition of the thesis

The thesis begins with a review of the literature: firstly with an introduction to diabetes and periodontitis (Chapter 2), followed by the case for inter-professional working between medicine and dentistry in the context of diabetes and periodontitis (Chapter 3). The following four empirical chapters describe four interrelated studies. Medical and dental surveys were conducted to identify behavioural and organisational correlates of primary care clinician behaviours in the context of diabetes and periodontitis best practice recommendations. The medical professional self-reported survey findings (Chapters 4) suggested that best practice recommendations were not being followed. Knowledge was clearly an issue, both in relation to the evidence linking the diseases and published guidance; however, whilst clinicians recognised the behaviours were not their normal practice, they were valued and perceived to align with professional role, particularly that of nurses. The dental professional self-reported survey findings (Chapter 5) indicated that whilst some best practice recommendations were followed, there was poor uptake of communicating with the patient's general practitioner (GP), which was experienced as problematic for a variety of reasons. The survey findings were disseminated in iterations of workshops with patients, medical and dental professionals, and oral health interventions were developed that were perceived to be feasible and acceptable for delivery in primary medical care (Chapter 6). Two interventions were then pilot trialled in two practices in the North East of England. They were evaluated in terms of experienced feasibility and acceptability, and were found to be acceptable by patients and nurses in particular (Chapter 7). The challenges of inter-professional working in the context of diabetes and periodontitis feature throughout the thesis. Whilst medical and dental professionals have indicated a preference for indirect referrals or signposting patients, findings would suggest that there may be occasions when this inadvertently places the patient in a difficult position, both in terms of accessing National Health Service (NHS) periodontal treatment and being assessed for a diabetes diagnosis. The final discussion chapter explores the key findings and strengths and weaknesses from each of the studies; in addition to considering the implications for clinical care; and concludes with the impact of the research to date and a proposal for future research (Chapter 8).

Chapter 2

Chapter 2: Introduction to Diabetes and Periodontitis

The links between diabetes and periodontitis have been recognised by dental professionals for many years, particularly since the landmark publication by Harald Löe in 1993, in which he described periodontitis as 'the sixth complication' of diabetes (Löe 1993). Since then, knowledge on the links between the two diseases has expanded, with improved understanding of the pathogenic mechanisms linking the conditions as well as evidence to support the benefits of periodontal treatment on glycaemic control in people with diabetes. It is important to understand, in broad terms, patient care and service provision in relation to diabetes and periodontitis to set the context for the survey work and development and evaluation of oral health interventions that are described later in this thesis. In this chapter, therefore, aspects of classification, diagnosis and management of diabetes and periodontitis, and organisation of healthcare services will be discussed.

2.1 Diabetes (mellitus)

The first reference to diabetes was recorded by the Egyptians in 1550 BC who described it as a polyuric state causing rapid weight loss. It was due to the urinary symptoms that the Greeks adopted the term 'diabetes' in the second century AD, meaning 'siphon' or 'pass through'. At the end of the 18th century the term 'mellitus' was added which is Latin for 'honey', thus describing glycosuria and distinguishing diabetes mellitus from diabetes insipidus which, although characterised by thirst and frequent urination, is not related to diabetes. Over recent years, there appears to have been a trend to more simply refer to 'diabetes' (rather than 'diabetes mellitus') both in professional and lay publications, specifically in the context of type 1 diabetes and type 2 diabetes. For the purposes of this thesis, the term diabetes will be used in preference to the term diabetes mellitus.

2.1.1 Diabetes definition

The World Health Organisation (WHO) defines diabetes as a metabolic disorder of multiple aetiology characterised by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both (World Health Organisation 1999). Diabetes is associated with the development of complications arising from the long-term damage, dysfunction and failure of various organs that have significant impacts on well-being and quality of life. Complications include retinopathy, nephropathy, neuropathy, cardiovascular and cerebrovascular disease, and sexual dysfunction. In severe cases, a hyperosmolar hyperglycaemic state and ketoacidosis may occur leading to seizures, coma and death (World Health Organisation 1999); however often symptoms are

less severe and can go unnoticed by both patients and clinicians until significant pathological and functional damage has occurred.

2.1.2 Diabetes diagnosis

A clinical assessment and subsequent diagnosis of diabetes is often prompted by symptoms which include thirst, polyuria, blurring of vision and weight loss (World Health Organisation 1999). A diagnosis of diabetes can be made using a random venous plasma glucose test, a fasting plasma glucose test, a two-hour plasma glucose tolerance test following 75g oral glucose, or a non-fasting glycated haemoglobin (HbA1c) measure (World Health Organisation 2011b). Prior to 2011, a diagnosis of diabetes was made according to the presence of diabetes symptoms (e.g. polyuria, polydipsia and unexplained weight loss for type 1 diabetes) plus:

- a random venous plasma glucose concentration ≥ 11.1 mmol/L, or
- a fasting plasma glucose concentration ≥ 7.0 mmol/L (whole blood ≥ 6.1 mmol/L), or
- a two hour plasma glucose concentration ≥ 11.1 mmol/L two hours after 75g anhydrous glucose in an oral glucose tolerance test (OGTT).

The WHO defines fasting plasma glucose concentrations as (World Health Organisation 2006):

- impaired fasting glucose: between 6.1 and 6.9 mmol/L (between 110 mg/dL and 125 mg/dL)
- diabetes: 7.0 mmol/L and above (126 mg/dL and above)

The units used to describe plasma glucose levels vary in different countries, with the UK primarily using millimoles glucose per litre of plasma (mmol/L), whereas in the United States of America (USA) and continental Europe primarily use milligrams glucose per decilitre of plasma (mg/dL). For the purpose of this thesis, the UK units (mmol/L) will be used. The fasting plasma glucose threshold for diabetes of 7.0 mmol/L is a concentration associated with the development of microvascular complications, particularly retinopathy (World Health Organisation 2006).

Thresholds for plasma glucose concentrations following the OGTT are as follows:

- normal: fasting value (before test) <6 mmol/L, and at 2 hours <7.8 mmol/L
- impaired glucose tolerance (IGT): fasting value (before test) 6.0 to 7.0 mmol/L, and at 2 hours: 7.9 to 11.0 mmol/L
- diabetes: fasting value (before test): >7.0 mmol/L, and at 2 hours >11.0 mmol/L

Clearly, diagnosis of diabetes is complex, with a number of options for investigations for making a diagnosis of diabetes, and with different units of measurement being used in different countries around the world. Furthermore, different thresholds for defining normal plasma glucose levels (normoglycaemia) and diabetes (hyperglycaemia) have been used over the years.

In 2011, WHO made the decision to accept the use of non-fasting HbA1c values in the diagnosis of diabetes, with the value of 6.5% identified as the threshold for a diagnosis of diabetes (World Health Organisation 2011b). The benefit of this test is that fasting is not required, and as a result of improvements in analytical techniques, there is greater consistency of HbA1c measurements in diagnostic laboratories around the world enabling this parameter to be reliably used in the diagnosis of diabetes. HbA1c measurements reflect the plasma glucose concentration over the previous two to three months (the lifespan of erythrocytes), and consequently the measure can be affected by anaemia and haemoglobinopathies.

A further complexity with respect to the use of HbA1c is the choice of measurement units, with the Diabetes Control and Complications Trial (DCCT) aligned assay units measured in % (i.e. percentage of haemoglobin that is glycated), and the International Federation of Clinical Chemistry (IFCC) aligned assay units measured in mmol/mol. In the UK and Europe, HbA1c values are now reported according to the IFCC units (mmol/mol) whereas in the USA, the DCCT units (%) continue to be reported. For a period of time in the UK, many clinicians used conversion charts to familiarise themselves with the IFCC numbers and both units tend to be reported on websites (such as the Diabetes UK website) and in scientific publications. For the purpose of this thesis, both values will be reported as appropriate (e.g. when referencing publications that used either or both values). Accordingly, the diagnostic threshold for diabetes is based on non-fasting venous HbA1c measurements of 48 mmol/mol (6.5%).

The term ‘prediabetes’ is often used to define hyperglycaemia that does not reach the threshold to be classed as diabetes. Prediabetes could also be referred to as impaired fasting glycaemia if the test is based on a fasting blood glucose sample, or as IGT, if the test is based on an OGTT sample. It is important to note that the WHO does not recognise the clinical term ‘prediabetes’. In their document accepting the use of non-fasting HbA1c measurements in the diagnosis of diabetes, they indicate that whereas the threshold of 6.5% (48 mmol/mol) is diagnostic for diabetes, a value of <6.5% does not exclude diabetes diagnosed using glucose tests, and that there is insufficient evidence to make any formal recommendation on the

interpretation of HbA1c levels below 6.5% (World Health Organisation 2011b). Nonetheless, the term 'prediabetes', while not constituting a formal diagnosis, is useful as an indicator of risk for diabetes, and as a useful way of conceptualising risk to patients as well as predicting risk at the population level.

It has been estimated in an analysis of 20,000 adults who participated in the Health Survey for England that approximately one-third of adults in England have prediabetes, with the prevalence increasing from 11.6.% in 2003 to 35.3% in 2011 (Mainous *et al.* 2014). Furthermore, in 2011, 50.6% of the population who were overweight (body mass index (BMI) >25) and who were 40 years of age or older, had prediabetes. In this particular study, the authors used an HbA1c range of 5.7% (39 mmol/mol) to 6.4% (46 mmol/mol) in people who had not been previously given a diagnosis of diabetes to define the presence of prediabetes. These criteria were specified by the American Diabetes Association (ADA) to define prediabetes, being the only organisation which uses these criteria, and these thresholds have been shown previously to be predictive of progression to diabetes (Morris *et al.* 2013). Notwithstanding the above research, in the UK there are no defined criteria for prediabetes or borderline diabetes, though clinicians frequently use such terms with their patients. However, the very rapid rise in the prevalence of prediabetes from 2003 to 2011 in England presents huge concerns as it indicates that large changes can occur at the population level within a short period of time, and this condition puts individuals at high risk for developing diabetes.

2.1.3 Diabetes classification

WHO published the first widely accepted classification in 1980 (Holt and Hanley 2012) which was modified by the ADA in 1997 according to aetiology and clinical stages, and subsequently adopted by WHO in 1999 (World Health Organisation 1999). The classification of diabetes has four broad categories: type 1 diabetes, type 2 diabetes, gestational diabetes, and other specific types of diabetes (secondary to genetic defects and other pathologies) (American Diabetes Association 2014).

Type 1 and type 2 are the principal categories of diabetes. Type 1 diabetes (historically referred to as both insulin-dependent diabetes mellitus and juvenile diabetes) is caused by an absolute deficiency of insulin due to autoimmune destruction of the β-cells of the islets of Langerhans in the pancreas. As the number of β-cells decreases, insufficient quantities of insulin are produced to control blood glucose levels, and the symptoms of diabetes (hyperglycaemia) develop. Although type 1 diabetes can affect any age group, diagnosis is generally during childhood, adolescence or young adulthood. Treatment involves daily

injections of insulin, without which death would occur (Holt and Hanley 2012). The precise aetiology of type 1 diabetes is yet to be established, but it is believed that the condition results from a combination of genetic predisposition and an environmental trigger. The most likely candidate for the environmental trigger is infection with an enterovirus, but other postulated causes include lack of vitamin D, vaccines and cows' milk. Type 2 diabetes (historically referred to as non-insulin dependent diabetes mellitus and adult-onset diabetes) accounts for 90% of all cases of diabetes in Western Europe and USA. It is caused by both impaired insulin secretion and resistance to insulin (Holt and Hanley 2012). It is a complex disease and recent research has highlighted its heterogeneity with identification of five replicable clusters of patients with diabetes which had differing characteristics of disease progression and risk of complications (Ahlqvist *et al.* 2018). Such stratification may ultimately lead to individually-tailored management strategies (precision medicine) though more research in this area is required. The incidence of type 2 diabetes increases with age, with the majority of cases being diagnosed 40 years upwards, however there is an increase in younger adults and children developing type 2. Treatment involves a stepped approach to reducing hyperglycaemia with lifestyle changes, including weight loss, smoking cessation and increasing exercise uptake; and the introduction of oral and injectable medications.

Gestational diabetes is a form of diabetes caused by hyperglycaemia during pregnancy. Incidence is one in 25 pregnancies worldwide and it is associated with complications to both mother and foetus. Normoglycaemia usually returns following the birth, however, approximately half of women will go on to develop type 2 diabetes within five to ten years after delivery. The other specific types of diabetes includes genetic defects of β-cell function and insulin action; diseases of the pancreas; endopathologies; secondary diabetes relating to drugs, chemicals or infections; rare immune-related; and other genetic syndromes associated with diabetes (American Diabetes Association 2014).

2.1.4 Epidemiology of diabetes

Diabetes prevalence and projection figures are frequently described within a narrative of 'global health emergency', 'global epidemic' or 'global burden' (Diabetes.co.uk 2018a). In 2017, the International Diabetes Federation (IDF) stated that 425 million people worldwide or 8.8% of adults aged 20-79 are estimated to have diabetes (International Diabetes Federation 2017). This is predicted to rise to 629 million by 2045, with the largest increase appearing in low to middle income countries. In the UK, there are almost 3.7 million people with diabetes (type 1 or type 2) and an estimated 1 million with undiagnosed type 2 diabetes, which when combined means that 6% of UK adults have diabetes (Diabetes UK 2018a). This is predicted

to rise to 5 million by 2025. Type 2 diabetes is the most prevalent form of diabetes, accounting for 90% of all diabetes cases, with type 1 diabetes accounting for approximately 10%.

2.1.5 Treatment of diabetes

Diabetes is a chronic non-communicable disease with multiple impacts on body systems leading to reduced quality of life. Treatment of diabetes requires a life-long management strategy and varies in complexity given the multifactorial aetiology of the condition. Treatment of type 1 diabetes typically involves a carefully planned diet (to manage intake of sugars and carbohydrates in particular), planned physical activity, injection of insulin several times per day, and self-monitoring of blood glucose levels. Treatment of type 2 diabetes involves weight loss, regular exercise, diet control, self-monitoring of blood glucose levels, oral medications, and insulin injections. Clearly, compliance with all of these aspects of care is challenging, particularly when risk is linked to lifestyle factors, such as diet and nutrition, exercise and body weight. Targets for blood glucose levels to be achieved by therapy vary according to the clinical situation, but the overall aim is to reduce blood glucose concentrations so that they are as close as possible to non-diabetic values (i.e. HbA1c target of <6.5%). Target levels are individual to each person and ideally should be agreed between the patient and their diabetes care team. For patients who are self-monitoring their blood glucose levels, targets are typically 4-7 mmol/L before meals and <8.0 mmol/L two hours after meals.

Of particular interest is recent evidence that rapid weight loss may lead to the reversal of type 2 diabetes (Lean *et al.* 2018). In this randomised controlled trial (RCT), adults who had been diagnosed with type 2 diabetes within the last 6 years underwent withdrawal of their anti-diabetes and anti-hypertensive drugs together with total diet replacement (825–853 kcal/day formula diet for 3–5 months), followed by stepped food reintroduction over 2–8 weeks. Diabetes remission, defined as HbA1c <6.5% (<48 mmol/mol) after at least two months and off all anti-diabetic medications, was achieved in 68 (46%) participants in the intervention group, with the authors concluding that type 2 diabetes remission is a practical target for primary care. This study presents exciting possibilities for the management of some patients with type 2 diabetes, though the low calorie diet was not without challenges for the participants.

2.2 Managing long term chronic conditions

Managing the complex needs of patients with chronic illness is also challenging. Wagner stated that primary care health systems typically are designed for the needs of acutely ill

patients with short appointments, and a focus on tests and investigations to facilitate prescribing appropriate medication (Wagner 2000). In 2002, WHO published a global report 'Innovative Care for Chronic Conditions: Building Blocks for Action' which presented a case for global reform and a new framework for health systems (World Health Organisation 2002). It stated that chronic conditions present mainly in primary healthcare settings which must evolve to effectively manage such conditions. WHO suggested that innovation could enable healthcare systems to shift their resources to encompass care for chronic conditions, and stated that decisions regarding policy-making and service planning need to account for the values of every stakeholder and align with different sectors. Healthcare systems must integrate across settings, providers and sectors to stop the fragmentation of services and create new team-based models of care that utilise healthcare workers with less formal education and build community support. The new framework was designed to triage a system of care that partnered patients and families, healthcare teams and community support workers; and centred on integration and collaboration between informed and motivated members (World Health Organisation 2002).

The long-term nature of chronic illness means that there needs to be a focus on prevention, patient self-management, education, support and frequent reviews to prevent exacerbations, complications and hospitalisation. The Chronic Care Model (Bodenheimer *et al.* 2002, Wagner 2000) was designed to place the patient in a self-manager role with a priority to increase patient engagement and empowerment through education and skills enhancement, similar to the prevention model (Von Korff *et al.* 1997). The model assumed the physician as central component of the model supported by a practice 'team', aided by increased interaction with specialists to ensure optimal care based on the most current evidence and perspectives. This model was based on the author's experiences of working in the USA healthcare system with recognition that successful management of patients with chronic diseases relies on integrated working by healthcare teams (including nurses and pharmacists) to ensure that those elements of care and patient management that doctors may not have the time or training to do well, but yet may be critical for improving outcomes, are undertaken and are performed well (Wagner 2000).

Increased awareness of the importance of innovation and team-working for management of complex, chronic conditions (such as diabetes) in the NHS has also developed in the United Kingdom (UK) through the implementation of various initiatives. A similar scheme to the Chronic Care Model was sponsored by the UK Department of Health

(DoH) in 2007 called The Year of Care Partnership (National Health Service 2007). This is an NHS-based scheme which supports the management of long term conditions through care and support planning. Importantly, the development of this Year of Care Partnership involved close collaboration and input from patients who are living with chronic conditions, who must manage their condition for 24 hours per day and 365 days per year, whereas they may have contact with the healthcare system for just a few hours per year. As part of the Year of Care, the DoH created a 'House of Care' model which emphasises the elements that must be in place to ensure effective care and support. Key aspects include the need for the patient to be informed and engaged with their care, and HCPs who fully embrace partnership working with the patient. Such an approach requires organisational structures and processes to be facilitative rather than creating barriers.

2.2.1 Acceptance of chronic care models

The 'Innovative Care for Chronic Conditions' global report (World Health Organisation 2002) stated that even with scarce resources, healthcare could be improved through leadership combined with a willingness to accept change and innovation. The acceptance of the expansion of primary care teams in diabetes care was examined by Ohman-Strickland who found that physicians were uncertain regarding the benefits of multidisciplinary teams (MDTs) (Ohman-Strickland *et al.* 2008). Physicians and ward managers raised concerns regarding the increasing use of nurse practitioners (NPs) and physician assistants as a primary point of contact for patients with diabetes with respect to quality of care, patient satisfaction and financial efficiency. There were also concerns raised by the physicians regarding a feeling of relinquishing control. Schweizer found that physicians associated collaboration with other HCPs with a level of conflict and losing responsibility, possible because historically, the physician held a position of total autonomy (Schweizer *et al.* 2017). McDonald identified issues around power dynamics and trust that negatively influenced physician and public sector HCP collaborations in diabetes care in Australia (McDonald *et al.* 2012). Three power dynamic themes emerged: physicians used power dynamics to protect their autonomy; operating between private and publically funded sectors caused difficulties with collaboration; and dependency on other HCPs was linked with a sense of vulnerability. The trust themes related to uncertainty regarding roles and competence of other HCPs which could be overcome with time and experience. Furthermore, Spilsbury found considerable challenges in the integration of assistant practitioners, an upskilled healthcare assistant

(HCA), introduced to diversify the workforce to aid recruitment and retention of frontline hospital staff, including registered nurses (Spilsbury *et al.* 2011).

These studies indicate that, whereas conceptually, multidisciplinary care would appear to offer potential for improving overall patient care, there are challenges relating to professional autonomy and power dynamics, issues around perceived loss of control, and systematic barriers which conspire to impact on effective inter-professional and multidisciplinary working in diabetes management.

2.3 Diabetes management in primary medical care

The NHS (in England) is led by NHS England. Health and social services are commissioned by local clinical commissioning groups (CCGs) and NHS England through a process of continual planning and monitoring, to ensure that services are delegated to appropriate areas. The provision and quality of NHS services are reviewed regularly to improve patient outcome measures and cost effectiveness of services. The National Institute for Health and Care Excellence (NICE) was founded in 1999 to reduce variation in the availability and quality of UK NHS care by providing evidence-based national guidance and advice to healthcare providers. NICE aims to improve health with the aid of guidelines, recommended disease pathways and quality standards which underpin the quality indicators produced each year. These indicators are outlined in the quality outcome framework (QOF), a voluntary annual reward for primary care medical practices, introduced by NICE in 2004. Although QOF is currently under review and criticised by some as a tick-box exercise, it generates an annual report of care delivery, and the results suggest that QOF has improved outcomes for patients with diabetes (Diabetes UK 2018c). Quality outcome indicators for diabetes include: maintaining a register of adult patients with diabetes; recording the percentage of patients who achieve the recommended targets for blood pressure, cholesterol and HbA1c; and recording the percentage of newly diagnosed patients who have been referred to a structured education programme within nine months of entry onto the diabetes register.

Initially NICE was founded to produce guidance on conditions which were politically prioritised, however, it now has a suite of clinical guidelines covering all major causes of morbidity and mortality, and appraises all new health technologies. There are 63 NICE products for diabetes alone, including pathways, guidance and quality standards. Indeed, the practicality of translating numerous guidelines into daily practice has been questioned in the literature (Allen and Harkins 2005). Furthermore, in 2012, a new Clinical

Knowledge Summaries (CKS) service was introduced through the NICE website to enable primary care clinicians to access up-to-date concise summaries of NICE guidance. These CKS aim to provide answers to clinical questions at the point of decision making, thus supporting the navigation of patients through appropriate care pathways, and supporting the continuous professional development of clinicians. Whilst they are referred to as 'summaries', they provide comprehensive information but in a bulleted format. CKS topics are written, reviewed and updated by a MDT of experts with experience of primary care, assisted by a network of specialist external reviewers. There are seven broad themes in the CKS for an adult with diabetes including creating an individualised care plan, screening for complications of type 2 diabetes and managing lifestyle issues.

Whilst the diabetes management guidance aims to standardise care, there remains a considerable variation in the organisation of primary care diabetes services on a practice level. Patients with chronic illness, such as diabetes, are reviewed regularly. They can be seen in specific diabetes clinics, or as part of clinics managing patients with a range of long term chronic diseases, or the patients can be seen at any time in amongst all other patients. Diabetes management can be overseen by a GP, a GP with special interest (GPwSI) in diabetes, a NP, a diabetes specialist nurse (DSN) or a practice nurse (PN). Diabetes care is frequently managed by a MDT, but the components of the team may vary from practice to practice. Diabetes MDTs can include a visiting health trainer or coach, dietician, podiatrist, and mental health nurse; and some extend to outreach ophthalmology services and educational programmes, such as Dose Adjustment For Normal Eating (DAFNE) and Diabetes Education and Self-Management for Ongoing and Newly Diagnosed (DESMOND) (Diabetes UK 2018b).

Generally, diabetes is monitored annually (or more frequently if necessary) and at a review appointment measures (such as HbA1c, blood pressure, cholesterol) are taken by a nurse or HCA/phlebotomist. The patient is then reviewed, sometimes on the same day, by the PN and/or GP/NP who will review the medication and provide educational and motivational support. Some clinicians use a template to standardise their review appointments. These templates are electronic checklists which act as an *aide memoire*. There are numerous templates available and, although the content can vary, it is generally informed by the QOF and/or CKS. For example, Ardens (https://www.ardens.org.uk/) is a healthcare informatics company that is the leading provider of SystmOne (a centrally hosted clinical computer system accredited by the NHS to detail a patient's contact with

primary care health services) templates and reports used by over 700 medical practices across England. Ardens also have contracts with nine Commissioning Care Groups and have also worked with the Royal College of GPs, British Medical Association, Wessex Local Medical Committee, Vanguards and prisons too. It was founded in 2013 by Dr Robert Greville-Heygate and is run by GPs who still work within primary care practice and know the issues that medical practices face on a daily basis. The diabetes template is in constant review and is updated according to NICE CKS. The template user can click onto field options that are linked to Read Codes. Read Codes are a coded thesaurus of clinical terms used in the NHS since 1985 that provide a standard vocabulary for clinicians to record patient findings and procedures in health and social care IT systems across primary and secondary care in the UK.

2.4 Periodontitis

The term 'periodontal disease' encompasses a range of conditions including gingivitis, periodontitis, periodontal conditions associated with systemic diseases, necrotising conditions, periodontal abscesses, periodontal-endodontic lesions, and developmental disorders affecting the periodontium. Over the years, numerous classification systems have been proposed by national and international societies of periodontology, generally based upon clinical presentation. Nomenclature has changed such that the most common form of the disease that compromises tooth retention has been variously referred to as adult periodontitis, chronic adult periodontitis, chronic periodontitis, and now, more simply, periodontitis. For the purpose of this thesis, the term 'periodontitis' will be used as this description is easily understood by dental clinicians worldwide and this terminology is consistent with the 2017 classification system (see below) proposed jointly by the EFP and the AAP (Caton *et al.* 2018).

2.4.1 Periodontitis definition

Periodontitis is a chronic inflammatory disease that is characterised by inflammation and progressive destruction of the tooth-supporting structures, specifically the gingiva, periodontal ligament and alveolar bone. It is characterised by erythema and oedema of the gingival tissues, gingival recession, apical migration of the junctional epithelium, destruction of fibres of the periodontal ligament (leading to attachment loss and periodontal pocket formation), tooth mobility and tooth loss (as a result of alveolar bone resorption). The inflammation that drives periodontitis is initiated and perpetuated by the

dental plaque biofilm, in which bacterial dysbiosis results in a chronic, non-resolving, tissue-destructive inflammatory response.

2.4.2 Periodontitis diagnosis

Periodontitis is a slowly progressing, chronic condition that is generally painless. As a result of this, whereas the earliest signs of gingival inflammation (i.e. gingivitis) may be recognised by patients as increased gingival bleeding (e.g. when brushing their teeth), this common sign is frequently overlooked, and may be regarded by many patients as essentially being 'normal'. Over the years, if the inflammation progresses to affect the deeper periodontal tissues (periodontal ligament and alveolar bone), given the absence of other signs or symptoms, the loss of attachment is very unlikely to be perceived by patients themselves until it has progressed to such an extent that there is visible gingival recession, or teeth become mobile, or may drift within the dentition (leading to spaces developing between teeth that did not previously exist). Thus, patients commonly present with advanced periodontitis that they were hitherto unaware of, even if they had been aware of bleeding gums.

Early identification and diagnosis of periodontal problems is essential for effective treatment. In practice, this means that examination by a dental HCP, i.e. a GDP or a dental hygienist/therapist (DHT), is necessary. A periodontal probe is used to assess the extent and severity of periodontal pocketing, with the Basic Periodontal Examination (BPE) being the recommended screening tool for identifying patients with disease (British Society of Periodontology 2016a). For those patients with evidence of periodontitis, a full-mouth periodontal examination is required, with recording of probing pocket depths at six sites per tooth together with radiographs to assess alveolar bone levels.

Over the years, a number of thresholds for defining the presence of periodontitis have been proposed, based on extent (i.e. numbers of affected sites in the dentition) and severity (i.e. based on probing pocket depths and/or attachment loss). Typically, these have been used in epidemiological studies to ascertain the prevalence of periodontitis and have been proposed by different scientific organisations. In 2005, the EFP proposed a periodontitis case definition for epidemiological purposes according to two levels of disease severity: (i) a sensitive case definition (presence of proximal attachment loss of $\geq$ 3mm in $\geq$ 2 non-adjacent teeth), and (ii) a severe case definition (presence of proximal attachment loss of $\geq$ 5mm in $\geq$ 30% of teeth) (Tonetti and Claffey 2005). In 2007, the

United States (US) Center for Diseases Control and Prevention (CDC) and the AAP published their own case definitions: (i) for moderate periodontitis (two or more interproximal sites with attachment loss ≥ 4 mm, not on the same tooth, or two or more interproximal sites with probing depths ≥ 5 mm, not on the same tooth), and (ii) severe periodontitis (two or more interproximal sites with attachment loss ≥ 6 mm, not on the same tooth, and one or more interproximal sites with probing depth ≥ 5 mm) (Page and Eke 2007).

These case definitions are complex to implement and were designed with epidemiological surveys in mind, for which there is a need to identify periodontitis cases versus non-cases. For the individual clinician treating the individual patient, these case definitions have limited benefit. There is an accepted dogma that probing pocket depths ≤ 3 mm constitute health, and that probing depths ≥ 5 mm constitute periodontitis (though not exclusively so), but with imprecision with respect to the number and depth of pockets needed to constitute a periodontitis case. Accordingly, most clinicians utilise a combination of clinical parameters (probing depths, bleeding on probing) and radiographic assessment of alveolar bone levels to reach a diagnosis of periodontitis in any particular patient.

2.4.3 Periodontitis classification

Periodontitis classification schema have evolved over the years in parallel with increased understanding of disease aetiology and pathogenesis, and some of the classification systems have included specific linkages with diabetes. In 1986, the first widely accepted classification of periodontal diseases was proposed by the AAP (American Academy of Periodontology 1986):

I Juvenile periodontitis (subdivided into prepubertal periodontitis, and localised/generalised forms of juvenile periodontitis)
II Adult periodontitis
III Necrotising ulcerative gingivo-periodontitis
IV Refractory periodontitis (i.e. unresponsive to treatment)

This was expanded and further developed in 1988 by Johnson and colleagues to aid in the detection of groups at high risk for periodontitis (including those with diabetes). Their classification was as follows (Johnson *et al.* 1988).

I Childhood periodontitis (including syndromes)
II Juvenile periodontitis (subdivided into localised/generalised forms)

III Post-juvenile periodontitis

IV Adult onset periodontitis (subdivided into slowly/rapidly progressing)

V Periodontitis associated with systemic diseases (including diabetes, scurvy, AIDS)

VI Traumatic periodontitis (e.g. recession as a result of abrasion)

VII Iatrogenic periodontitis (e.g. resulting from inappropriate restorations).

In 1989, the AAP further refined the classification, maintaining the concept of periodontitis associated with systemic diseases (American Academy of Periodontology 1989).

I Adult periodontitis

II Early onset periodontitis (subdivided into prepubertal periodontitis and juvenile periodontitis, each with localised and generalised forms, and rapidly progressive periodontitis)

III Periodontitis associated with systemic diseases

IV Necrotising ulcerative periodontitis

V Refractory periodontitis

During the 1990s, gradual dissatisfaction with this classification system arose due to the lack of a classification of gingival diseases, overlap between disease categories (e.g. the early onset forms of periodontitis) and inappropriate emphasis on age of onset of disease (which is usually not known). Therefore, in 1999, a further classification system was proposed by the AAP (Armitage 1999).

I Gingival diseases

II Chronic periodontitis (localised and generalised forms)

III Aggressive periodontitis (localised and generalised forms)

IV Periodontitis as a manifestation of systemic disease (haematological and genetic disorders)

V Necrotising periodontal diseases

VI Abscesses of the periodontium

VII Periodontitis associated with endodontic lesions

VIII Developmental or acquired abnormalities or conditions

Importantly, it was noted in the discussion paper that accompanied the classification document that diabetes was not included within the category “Periodontitis as a manifestation of systemic disease” (Armitage 1999). The workshop participants

considered that diabetes can be a significant modifier of all forms of periodontitis but that at that time, there were insufficient data to conclude that there is a specific diabetes-associated form of periodontitis. It was further stated that, the presence of uncontrolled diabetes can alter the clinical course of both chronic and aggressive periodontitis. However, this statement creates an inconsistency in the classification system, as one of the defining characteristics of the condition referred to as aggressive periodontitis is that patients can be systemically healthy (Lang *et al.* 1999), and therefore a diagnosis of aggressive periodontitis is challenging to make in a patient with diabetes, even though patients with diabetes undoubtedly present with clinical signs and symptoms of generalised aggressive periodontitis. A further inconsistency in the 1999 classification is that 'diabetes-associated gingivitis' is included as a diagnosis in the classification of gingival diseases (whereas no such equivalent for periodontitis was listed, as described above) (Armitage 1999). The workshop participants justified this on the grounds that plaque-induced gingivitis was considered a single entity whereas the same cannot be said for periodontitis.

These problems (and others) with the 1999 classification resulted most recently in a new classification being jointly proposed by the EFP and the AAP following a joint workshop held in 2017 (Caton *et al.* 2018). Guidance documents for implementing the new classification are being produced, and the recommendation from the British Society of Periodontology (BSP) is to continue using the 1999 classification system until such guidance is available. The new system attempts to stage and grade periodontitis according to extent, severity and risk, with elimination of the terms 'chronic periodontitis' and 'aggressive periodontitis'. With respect to the links between periodontitis and diabetes, the workshop participants concluded that although 'diabetes-associated periodontitis' should not be regarded as a distinct diagnosis, diabetes should be recognized as an important modifying factor and included in a clinical diagnosis of periodontitis as a descriptor (Jepsen *et al.* 2018). It was considered that whereas there are no characteristic phenotypic features that are unique to periodontitis experienced by patients with diabetes, the level of glycaemic control in diabetes will be used to influence the grading of periodontitis, and thus incorporate an assessment of disease risk in the classification structure. Given that this classification was published in the early summer of 2018, and represents a considerable paradigm shift in classifying periodontal diseases, it is likely that the dental community will take some time to integrate it into their daily work. However, inclusion of diabetes as a modifying factor into the written periodontal

diagnosis, together with inclusion of the level of glycaemic control in the disease grading are important advances that will help the dental team to consider the wider general health perspective of their patients with diabetes as they formulate their periodontal diagnosis and treatment plan.

2.4.4 Epidemiology of periodontitis

The stated epidemiology of periodontitis has varied over the years due to different thresholds for identifying a periodontitis case being used in different studies. A recent meta-regression of 72 studies (including a total of 291,170 individuals aged 15 years or older in 37 countries) identified that global prevalence of severe periodontitis (indicated by any site with Community Periodontal Index of Treatment Needs (CPITN) score = 4, or attachment loss >6 mm, or probing depth >5 mm) was 11.2%. The authors identified severe periodontitis as the sixth-most prevalent disease in the world (Kassebaum *et al.* 2014). No significant differences in prevalence were identified between men and women, and prevalence increased gradually with age, particularly increasing in the 30s and 40s with a peak in incidence around 38 years of age. Prevalence peaked at around 40 years of age. These global prevalence data are comparable to the UK prevalence data, in which 8% of adults have been reported to have advanced periodontitis, manifested by probing depths of 6 mm or greater (White *et al.* 2011).

2.4.5 Treatment of periodontitis

Treatment of periodontitis involves professional care to directly reduce the bacterial challenge (oral hygiene instruction, OHI, and root surface instrumentation, RSI) together with patient education, motivation and empowerment to optimise oral hygiene through self-care and reduce or eliminate risk. The role of the patient in managing their condition must be emphasised so that they can establish the appropriate behaviours (both oral hygiene and life style behaviours), and reduce risk factors such as smoking. As a chronic non-communicable disease, periodontal treatment must be regarded as a life-long strategy, with patients requiring long-term maintenance care. Similar to diabetes, the treatment of periodontitis varies in complexity depending on the clinical situation and presence of risk factors. In some specific situations, additional adjunctive therapies such as antibiotics may be required, or periodontal surgery may be considered. In general, in terms of clinical technique, the treatment of periodontitis in patients with diabetes is very similar to treatment of periodontitis in patients who do not have diabetes. However, in patients with diabetes, there is a need for patients to be aware of the important links

between the two diseases, how they affect each other, and the importance of optimising diabetes control as well as optimising periodontal treatment outcomes.

2.5 Periodontal treatment in primary dental care

NHS primary dental care has been the focus of considerable government, media and public attention over the years. GDPs in primary dental care practices are not directly employed by the NHS, but are classed as independent contractors, providing services for which they are remunerated. Historically, GDPs in the UK were paid via an item-of-service fee schedule, which remunerated each treatment procedure individually (and is still in place in Scotland and Northern Ireland). Some patients were exempt from patient charges but over the years, the categories of patients who do not have to pay for treatment have reduced, and now include those aged under 18 (or under 19 if in full-time education), pregnant or have had a baby in the previous 12 months, or are in receipt of certain benefits (e.g. income support). Under the item-of-service schedule, non-exempt patients had to pay a significant percentage (80%) of the overall treatment costs even though the treatment was being delivered under an NHS contract. Concerns around the item-of-service approach related to the potential for over-treatment to increase income, as well as lack of governmental control over costs (relating to the 20% portion paid by the NHS for non-exempt patients and the full cost for exempt patients), as if a GDP worked harder in a particular financial year, they could increase their income, and therefore costs to the NHS.

In 2006, the 'new' dental contract was implemented in England and Wales as a reform of NHS dentistry (National Health Service 2005). This introduced the concept of the Unit of Dental Activity (UDA), which essentially are designed to measure dental practice activity to ensure the correct amount of charges are applied to dental treatment provided. The commissioners (Primary Care Trusts in England, and Local Health Boards in Wales) set targets that the practice must achieve (and that all practice members contribute to achieving). If these targets are not achieved, financial penalties can be applied. In practical terms, a UDA is a value applied to a course of treatment, and UDAs are broken into 3 bands. Practices are paid according to the course of treatment (and not the actual treatment that is provided). Thus, as an example, the payment for an extraction is the same as the payment for a root canal treatment (as both are classed as Band 2 UDAs). The time and practice cost involved for an extraction is generally far less than that required for a root canal treatment, and this has led to deep resentment of this system

within primary care dentistry as well as the potential for GDPs to be more likely to recommend extractions (for example) than other forms of care such as root canal treatments. UDAs are claimed for non-exempt patients as well as exempt patients and children, even though the latter do not pay themselves. The three UDA bands (National Health Service 2018) and current patient charges (which are paid by the patient if not exempt) are:

- Band 1 (£21.60): clinical examination, radiographs, scaling and polishing, preventive dental work, such as oral health advice – 1 UDA
- Band 2 (£59.10): this includes everything in Band 1, plus fillings, root canal treatment, extractions, surgical procedures and denture additions – 3 UDAs
- Band 3 (£256.50): this includes everything in Bands 1 and 2, plus crowns, dentures, bridges, and other laboratory work – 12 UDAs.

Periodontal treatment falls within Band 2, which includes treatment for severe periodontitis, as well as certain periodontal surgical procedures such as gingivectomy and free gingival grafts (which would primarily be undertaken only by specialists). The patient charges shown above do not exactly match with UDA values received by the GDP, and patients are not always clear that they are, in fact, paying 100% of the cost of their NHS treatment (according to the UDA system) even though they are receiving NHS care.

According to the BDA, in 2013, the average UDA value was £25.61 (British Dental Association 2013), which means that a full course of periodontal treatment in a patient with generalised advanced periodontitis would be remunerated at approximately £75. It has been estimated that it takes approximately 130 to 180 minutes to provide the necessary initial periodontal therapy for patients with this level of disease (Koshy *et al.* 2005), and then further ongoing treatment over the following months is required as part of periodontal maintenance care. Anecdotally, this is leading to under-treatment of periodontitis in primary care with increased referrals to secondary care centres. In Scotland, the remuneration is similarly poor, with a fee of £68.05 (of which non-exempt patients pay 80%) for a treatment of generalised advanced periodontitis (NHS Scotland 2018b).

Dissatisfaction with the NHS primary care remuneration system has led many GDPs to increase their proportion of private work, or even leave the NHS completely and become completely private. In 2013, 15% of GDPs who responded to a BDA survey were in fully

private practice, with a further 22% working up to 50% of the time in private practice (British Dental Association 2013). Within private practice, GDPs can allocate more time to the treatment of periodontitis (either by themselves or DHTs), and although no data are available on the typical charges applied in the private sector, anecdotally this may be approximately £30 for 15 minutes of surgery time. There has also been a rise in corporate dental organisations, with 23% of GDPs working for dental corporates. These organisations bid for contracts with the commissioners on a large scale and set their own internal fee and remuneration system. Indeed, many GDPs are charged if they refer a patient for treatment by the DHT within their own practice, anecdotally leading to GDPs retaining patients within their own care to avoid these charges. At the other end of the scale, 19% of practices are single-handed practices, with only one GDP working there (British Dental Association 2013).

It is clear that the effective management of a chronic disease such as periodontitis is challenging in primary dental care. As a result of the 2009 Steele report (Steele 2009), the focus has switched to develop dental contracts which incentivise improving health, improving access to dental care, and improving quality. On a practical basis, this would include payments for continuing care responsibility, together with rewards for both activity (i.e. numbers of treatments provided) and quality. Such 'blended' contracts (which reduce the prominence of UDAs, though they will still remain) are currently being piloted at certain locations in the country, and are yet to report.

2.6 Summary

Both diabetes (particularly type 2) and periodontitis present complex challenges for patient management. Both are chronic diseases with heterogeneous presentation and multiple risk factors, and both require effective team-working involving a range of HCPs with various skills and training working in partnership with actively participating patients to optimise treatment outcomes. Organisational structures need to be in place to facilitate delivery of high quality care, and management of diabetes is at a more advanced stage in this regard (for example, via innovations such as the House of Care) than is management of periodontitis. The aim of this thesis is to develop and evaluate oral health interventions to improve the inter-professional management of periodontal health as part of overall diabetes management in primary care. Therefore, is it necessary to now review the methodological approaches that can be employed to evaluate behaviours and intentions of clinicians, and these will be considered in the next chapter.

Chapter 3

Chapter 3: Oral-systemic connection and a case for intervention

Oral and dental disease has been generally separated from systemic disease since the mid-twentieth century in terms of organisation and management (Adams 1999, Davis 1980), with diseases being treated in different buildings; managed by different professions (which are regulated by different organisations); and remunerated (in primary care) via different healthcare systems. Notwithstanding, the impact of oral and dental disease on systemic disease is significant and the reciprocal nature of diseases such as diabetes and periodontitis should therefore be considered by both medical and dental professionals in the management of their patients. Previously, diabetes and periodontitis and the management thereof have been described separately (Chapter 2). This chapter brings diabetes and periodontitis together with a review of the evidence that links the diseases and the current clinical guidelines for best practice. This is followed by a case study of a novel approach to multidisciplinary diabetes management in the USA which incorporates a dental component; and the chapter concludes with the behavioural and implementation theories which will be utilised in the subsequent chapters.

3.1 Diabetes and periodontitis – a bidirectional relationship

Diabetes was initially identified to be a risk factor for periodontitis in the 1990s; the risk of periodontitis being increased by 2-3 times in a person with diabetes compared to individuals without (Löe 1993, Mealey and Ocampo 2007). The level of glycaemic control is key in determining risk (Tsai *et al.* 2002), and similar to the other complications of diabetes, the risk for periodontitis increases with poorer glycaemic control (Pihlstrom *et al.* 2005, Soskolne and Klinger 2001).

Periodontal disease is very common and can range from gingivitis (reversible inflammation of the gingiva or gums) to periodontitis (inflammation that extends from the gingiva to cause destruction of the surrounding connective tissues and alveolar bone resorption) (Preshaw *et al.* 2012). Meta-analyses and numerous Cochrane reviews confirmed reductions in HbA1c can follow effective periodontal therapy up to 0.40% (4 mmol/mol) 3-4 months after conventional periodontal therapy, a clinical impact equivalent to adding a second line pharmacological regime (Darré *et al.* 2008, Janket *et al.* 2005, Simpson *et al.* 2010, Simpson *et al.* 2015).

The pathogenic mechanisms linking periodontitis and diabetes are incompletely understood but likely relate to upregulated systemic inflammation in each condition adversely affecting the other. The mechanism by which diabetes increases risk for periodontitis is that

hyperglycaemia leads to increased deposition of advanced glycation end-products (AGEs) in the periodontal tissues which activate (via the macrophage receptor, RAGE, the receptor for AGEs) local immune dysfunction, increased secretion of cytokines (e.g. interleukin (IL)-1β, tumour necrosis factor (TNF)-α, IL-6), increased oxidative stress, and disruption of the receptor activator of NF-κB ligand/osteoprotegerin (RANKL/OPG) axis to favour bone resorption, all of which result in local tissue damage, connective tissue breakdown and resorption of alveolar bone, thus exacerbation of periodontitis. Adiposity and pro-inflammatory adipokines secreted by adipose tissue further contribute to the pro-inflammatory environment.

When considering the impact of periodontitis on diabetes, the postulated mechanism linking the diseases in this direction is that periodontal bacteria and their products together with inflammatory cytokines and other mediators produced locally in the periodontium enter the circulation and contribute to an upregulated systemic inflammatory state which leads to impaired insulin signalling and insulin resistance, thus exacerbation of diabetes. The resultant increased HbA1c levels contribute to increased risk of diabetes complications, including periodontitis, thus establishing a two-way relationship between the diseases (Polak and Shapira 2018).

Periodontal treatment in a patient with diabetes will result in a reduction of the bacterial load in the subgingival environment together with concomitant reductions in periodontal inflammation. Thus, reduced levels of circulating bacteria and pro-inflammatory cytokines (such as TNF-α and C-reactive protein) result from effective periodontal therapy (Loos 2005). The precise mechanisms for the reduction of HbA1c following periodontal treatment is not completely clear but almost certainly arises from the combined effects of reduced systemic inflammation and reduced bacterial challenge systemically, which leads to a reduction in the systemic inflammatory state, and improvements in insulin resistance and insulin signalling (Polak and Shapira 2018). In turn, these effects will result in a reduction in HbA1c, which is known to be very important in patients with diabetes, as reduction in HbA1c reduces the risk of diabetic complications. Research carried out by Stratton et al in 2000, reported that each 1% reduction in HbA1c is associated with 21% reduced risk of any endpoint related to diabetes, 21% for deaths related to diabetes, 14% for myocardial infarction and 37% for microvascular complications (Stratton *et al.* 2000).

3.1.1 Recommendations for a multidisciplinary approach to patient care in the context of diabetes and periodontitis

Over the years, a number of working groups have been established to provide guidance and recommendations for the management of patients with periodontitis and diabetes (Table 3.1). The World Dental Federation (WDF) and the IDF jointly organised a symposium on Oral Health and Diabetes in 2007, at the Federation Dentaire Internationale (FDI) Annual World Dental Congress in Dubai (sponsored by Colgate). The experts agreed that there was urgent need to inform professionals, people with diabetes, policy makers and the public about the impact of diabetes on oral health; and as a result, they produced the IDF Guideline on Oral Health for People with Diabetes which is available to download from the IDF website (International Diabetes Federation 2009). This guideline recommends that medical professionals should advise people with diabetes that good oral hygiene and regular dental checks are important and, in addition, adequate oral hygiene should be considered a normal part of diabetes self-management. It suggests patients with diabetes should be informed that poorly controlled diabetes can adversely affect periodontal health and periodontitis is associated with poorer quality of life indicators. It states that medical professionals should assess the periodontal status of their patients through a review of any symptoms (such as, bleeding when brushing and swelling/redness of gums) or the use of a self-report questionnaire (Eke and Genco 2007), and advises seeking professional attention for further investigation. The guideline group refer to the variable quality of evidence (the document has not been updated since 2007) regarding whether a periodontal surveillance programme should be instituted in people with diabetes, but based on the fact that good oral hygiene and regular dental attendance is recommended to the general population, and that people with diabetes are already reviewed annually to monitor health and complications, they published the guidance document and conclude that those involved in diabetes care should cooperate in the detection and management of diabetes within the oral health environment.

Experts from the EFP and AAP reviewed the current evidence regarding the associations between diabetes and periodontitis at the 9th European Workshop in Periodontology, November 2012 (van Dyke and van Winkelhoff 2013). They concluded that periodontitis was an independent predictor of several systemic conditions, including diabetes, and should be acknowledged as a major public health issue as it causes devastating oral and general health effects for individuals and society. Their manifesto stated that dental and medical communities should unite to develop a multidisciplinary approach to patient care. Guidelines were produced for the periodontal care of patients with diabetes and recommendations for

patients/public (European Federation of Periodontology 2012). These guidelines indicated that prevention, early diagnosis and effective treatment of periodontitis should form part of the management of diabetes from the point of initial diagnosis and continue thereafter. They refer to the bidirectional relationship of diabetes and periodontitis and suggest that patients presenting with risk factors for diabetes (without a diagnosis) should be informed about their risk, assessed using a point of care HbA1c test and referred to their physician for further investigation and follow up.

The BSP published their 'Good Practitioners Guide to Periodontology' in 2016. This guide contains information regarding various risk factors for periodontitis, including the link with poorly controlled diabetes, warning against poorer treatment outcomes due to delayed wound healing. It recommends the assessment of glycaemic control and suggests inter-professional communication with the patient's physician, particularly in the case of suspected diabetes. BSP also launched their 'gum awareness campaign' in 2017 and produced infographics for medical professionals and patients with diabetes, alerting them to the periodontal complications of diabetes (British Society of Periodontology 2017).

The UK NHS Public Health England (PHE) and DoH produced a toolkit of evidence-based prevention called 'Delivering better oral health' (Department of Health 2017). This was originally published in 2007 and is currently in its 3rd edition. It recommends how to manage periodontitis risk factors, including diabetes, emphasising the impact of poor glycaemic control and suggests contacting the patient's GP for details of their HbA1c via a template referral letter (Appendix 1).

Table 3.1 Guidance and recommendations for the management of patients with periodontitis and diabetes

Author	Name of document	Year	Professionals	Summary of recommendations
IDF	Guideline on oral health for people with diabetes	2009	Medical	To enquire annually regarding oral self-care and symptoms of periodontitis; inform about the links; and advise to go to GDP regularly.
EFP	Manifesto: periodontitis and general health	2012	Dental	Inform patients regarding links; advise regular periodontal monitoring; recommends dental and medical collaboration including when there is suspected diabetes.
EFP/AAP	Consensus report and guidelines: diabetes and periodontal disease	2013	Medical and dental	Medical: To inform about the links; and advise to go for periodontal assessment. Dental: Inform patients regarding links; advise regular periodontal monitoring; recommends liaising with GP when there is suspected diabetes.
BSP	Good practitioners guide to periodontology (3rd edition)	2016	Dental	Inform patients regarding links and enquire regarding HbA1c levels; consider liaising with GP regarding HbA1c levels; and liaise with GP when there is suspected diabetes.
BSP	Gum awareness campaign	2017	Medical	Inform about the links.
DoH	Delivering better oral health: an evidence-based toolkit for prevention (3rd edition)	2017	Dental	Inform patients regarding links and enquire regarding HbA1c levels, consider liaising with GP regarding HbA1c levels using a template referral letter.
EFP/IDF	Consensus report & guidelines on periodontal diseases and diabetes	2018	Medical and dental	Medical: To inform about the links; advise to go for periodontal assessment; and collaborate with dental profession. Dental: Inform patients regarding links; advise regular periodontal monitoring; enquire regarding HbA1c levels; and assess risk of diabetes when suspected (validated questionnaire or ADA screening questions).

Most recently (2017) the EFP and the IDF held a joint workshop on diabetes and periodontitis, and the proceedings were published simultaneously as identical papers in the *Journal of Clinical Periodontology* and in *Diabetes Research and Clinical Practice* (Sanz *et al.* 2018a, Sanz *et al.* 2018b). The working group considered in detail the epidemiological evidence regarding the effect of periodontitis on diabetes, and identified consistent evidence to support an association between periodontitis and worsening glycaemic control (deterioration of HbA1c, fasting blood glucose and OGTT) in healthy (i.e. non-diabetic) patients. There was also evidence for an association between periodontitis and reduced glycaemic control in patients with diabetes (though the data in situation are not as clear as observed in the non-diabetic patients). There was clear evidence of increased risk of diabetes complication in patients with periodontitis and diabetes (compared to diabetic patients without periodontitis), and also evidence to support that severe periodontitis increases the risk of developing type 2 diabetes (adjusted hazard ratio rage of 1.19-1.33) compared to periodontally healthy individuals (Graziani *et al.* 2018).

The EFP/IDF working group also re-evaluated the evidence on the impact of periodontal therapy on diabetes outcomes by means of a review of seven meta-analyses on this topic published between 2013 and 2017. They identified that at 3-4 months post-treatment, periodontal therapy resulted in a reduction in HbA1c of about 0.40%, with a range of 0.27% to 0.48%) (Sanz *et al.* 2018a). This reduction was statistically significant and also considered to be clinically significant, of comparable benefit to an additional pharmacotherapy in a patient with diabetes (Madianos and Koromantzos 2018). There were insufficient data to confirm whether this reduction was maintained six months after periodontal treatment.

The consensus documents from the working group included a number of guidelines: for physicians and other diabetes healthcare workers; for patients with diabetes who are seen in the physician's office; for oral health professionals; for patients at the dental office who have diabetes or who are found to be at risk of diabetes; and for policy makers (Sanz and Kornman 2013). These guidelines emphasise the importance of patients with diabetes being made aware of their increased risk for periodontitis and referral from the medical team to the dental team for periodontal assessment. Similarly, the guidelines state that patients who attend a GDP who do not have diabetes, but who have risk factors for diabetes, should be informed about their increased risk and referred to a physician for appropriate diagnostic testing. The assessment of diabetes risk in the dental setting is suggested to be undertaken using a validated questionnaire, such as the FinRisk questionnaire (Lindström and Tuomilehto 2003, National Public Health Institute Finland and Finnish Diabetes Association 2003).

Whilst not a guideline for diabetes and periodontitis, the early screening for prediabetes and potential diabetes previously undiagnosed in a dental context has been reported in numerous papers in the dental literature (Lalla *et al.* 2015, Wright *et al.* 2014). The NICE public health guidance 38 (NICE PH38) (first published in July 2012 and updated in 2017) 'Type 2 diabetes: prevention in people at high risk' (National Institute for Health and Care Excellence 2017) recommends that providers of public health services screen people who are at high risk of diabetes, using a validated tool, such as the one endorsed by Diabetes UK and Leicester University, for determining risk (Appendix 2). The list of public health services included dental surgeries, as a means of accessing people who go to their doctors infrequently, whilst attending their dental surgery regularly. The use of HbA1c in the diagnosis of diabetes (except during pregnancy), since the implementation of WHO guidance 2011, has made this more practical, with analysis of laboratory venous samples or point of care devices of high quality, standardised tests are performed by trained individuals (John *et al.* 2012). In the absence of resources to measure HbA1c, the guidance recommends using the validated tool and those identified with moderate or high risk should be referred to their GP with the use of a template GP letter (Appendix 3).

3.2 The case for inter-professional working in the context of diabetes and periodontitis

The bidirectional relationship between diabetes and periodontitis would appear to be widely accepted by periodontal researchers all over the world (Sanz *et al.* 2018b) and dental professionals are fully equipped to manage the periodontal needs of their patients with diabetes. Notwithstanding, the most recent UK Adult Dental Health Survey (2009) stated that 39% of the population do not routinely attend a GDP (Morris *et al.* 2011); and Tomar and Lester suggested that oral health may not be a priority for people with diabetes (Tomar and Lester 2000). Previous research has found that people with diabetes generally have a lack of knowledge about the links between diabetes and periodontitis (Allen *et al.* 2008, Bissett *et al.* 2013) and self-reported twice daily tooth brushing was less common in adults with diabetes (Karikoski *et al.* 2002). Furthermore the report stated that the main reason for dental non-attendance (after 'having nothing wrong'), is not being able to find an NHS GDP, although there are other reasons (Sturrock *et al.* 2017, Zohoori *et al.* 2012). As diabetes care providers are generally not aware of the links between the two conditions, they are not routinely informing their patients about the importance of regular dental monitoring, and previous research suggests that the factors surrounding this problem are more complex than a lack of awareness (Bissett *et al.* 2013).

Primary prevention of diabetes and periodontitis is recommended by various organisations including NICE, IDF and numerous international periodontal societies (Table 3.1). The referral of patients with severe periodontitis for diabetes evaluation from dental professionals, and the referral of patients with poorly controlled diabetes for periodontal assessment from physicians would be an example of optimal collaborative practice between medical and dental providers of diabetes care. Lin et al, explored knowledge, awareness and attitudes of endocrinologists and GDPs towards such referral practices, with endocrinologists reporting a lack of knowledge directly influencing the subsequent low referral behaviours (Lin *et al.* 2014). Interestingly, for both professions it was seen that belief in the evidence, rather than just knowledge alone, was necessary for engagement in effective management strategies, which supported previous findings (Dopson *et al.* 2010, Larme and Pugh 2001, Weinberger *et al.* 1984). Ahdi et al, explored physicians' retrieval of periodontal evaluation data from GDPs for patients undergoing annual review of their diabetes, and found that albeit a suboptimal practice at present, the use of an oral health questionnaire, basically a summary of the oral health status, latest periodontal screening index (equivalent to the UK BPE or the CPITN) and treatment to date, a useful tool to aid cross disciplinary communication (Ahdi *et al.* 2015). The IDF recommend that diabetes physicians undertake an assessment of periodontitis risk using a self-report measure such as the one coproduced by the Division of Oral Health at the CDC and the AAP (Eke and Genco 2007).

Despite numerous recommendations for inter-professionalism in the context of diabetes and periodontitis, the implementation of models of collaborative practice and examples of multidisciplinary care that cross-over the dental and medical professional boundaries are scarce. The following case study describes a unique multidisciplinary exemplar of diabetes care that is inclusive of periodontal screening in the USA.

3.3 Diabetes and periodontal management in USA – a case study

A case study of integrated diabetes and periodontal management was carried out in 2015 at the Western Diabetes Institute (WDI) in Western University of Health Sciences Patient Care Centre, California, USA, to understand what an integrated service could look like in practice. The Institute, which opened in 2010, was founded and directed by Professor Andrew Pumerantz, a Professor of Internal Medicine, who set out to 'redesign diabetes care'. The patients with diabetes were assigned a coordinator who guided them through multidisciplinary care and a balanced score card, or Diabetes Cross Disciplinary Index (DXDI) (Appendix 4), was used to plan and monitor their health and complications. This MDT was novel as it

included a DHT who delivered periodontal assessment and treatment as part of routine diabetes management, which was atypical of diabetes care globally. The case study explores the redesign of diabetes care from an organisational perspective and the drivers which enabled the development of the service and implementation of the changes.

3.3.1 Organisation of care

There are numerous key features to the WDI diabetes care pathway. Some of these features can be observed in UK diabetes care pathways also, but some are novel and innovative. The key organisational features are described below and compared to the UK organisation of care.

- *Patient centric*

The redeveloped diabetes care pathway at WDI placed the patient at the forefront of their care, so rather than sitting passively during their consultation, awaiting test results and instruction regarding the management of their condition, they were the driver of their care. This mirrors the chronic care models described previously (Bodenheimer *et al.* 2002, National Health Service 2007, Wagner 2000, World Health Organisation 2002) which aim to empower the patient to prioritise and set goals that steer the direction of their care, thus taking more ownership and realising the potential they have to change the direction of their disease.

- *Comprehensive clinical assessment*

The patient journey at WDI began with a 'one stop shop' appointment, comprising lengthy and comprehensive assessments by a MDT, including a clinical pharmacist, endocrinologist and cardiologist technician (undertaking echocardiograms). Professor Pumerantz frequently employed task shifting to modify the roles of the staff, delegating tasks to less specialised health workers, for example the care coordinators. This created novel employment opportunities and attracted free thinking employees, who were further encouraged to be creative with their role. The aim was to allow the physicians to concentrate on delivering optimal medical care, whilst the patients were carefully guided through all of their appointments by the health coach or 'care coordinator'. Appointment duration with each member of the MDT was luxuriously long at an hour on average, with the emphasis on quality of care delivery, which was understandably applauded by the health professionals. The inevitable result, was to make the 'one stop shop', quite a lengthy and potentially gruelling schedule for the patient, lasting the full day. Patients were tired, but more often impressed by the thoroughness of the attention they received; a stark contrast to the short appointments which they commonly experienced in primary care in the US context.

- *Inclusion of the mouth*

The diabetes care pathway was designed to be completely comprehensive, with no associated comorbidity omitted. Professor Pumerantz had initially read an article about the links between diabetes and periodontitis published in *Diabetologia*, the journal of the European Association for the Study of Diabetes, in 2012 (Preshaw *et al.* 2012). Initially, he utilised the dental school (which was in the same building) and sought the help of one of the teaching staff, a retired GDP, who organised the clinical assessments; and those patients who were found to have periodontitis were advised to seek treatment at their own dental practice. The dean of the school eventually considered this arrangement cumbersome, and it was at this point that they employed a DHT. She not only carried out assessments, but also treatments in WDI, which was of benefit to those patients who were not able to access dental care.

The oral complication of diabetes appeared to be fully embraced by all members of the MDT, who recognised that including dental assessment in the overall management of diabetes was another unique aspect of WDI's care. Here the dietician/nutritionist, who was also trained to deliver diabetes education, talks with conviction, about the importance of a healthy dentition:

> …Well, what I would talk about in the class (diabetes education class) is the, is gum disease…because when, if there's, if there's gum disease, ((pause)) blood sugar goes up, there's insulin resistance, um, and, you know, if they have no teeth they can't chew…You know, so I go, I talk about that in the class because to me it's, it's a vital part of self-care, for goodness sakes, your mouth, your teeth is, ((pause)) is essential. (Dietician/Nutritionist/Diabetes Educator.)

During the interview, the dietician said that the importance of oral self-care was something she had been trained to include in diabetes education; however, even in her dietician/nutritionist role she considered it important to be able to chew effectively. In the UK, a dietician discussing dental health with a patient with diabetes would be very unusual.

- *Care coordinator - shared community*

In the case of WDI, the patient is helped to navigate through the maze of appointments by a member of staff in a modified health coach role, the care coordinator, who acts as a 'go between' with the patient and provider. They are a combination of administrator, councillor and motivator. The coordinators are experienced community health workers and therefore have a pre-existing knowledge of the population; an explicit knowledge, not only of clinical matters, but of the area the patients live in. For example, they were able to help the patients get to their appointments if they had access issues through knowledge of potential car sharing schemes. As the population of Pomona is 70% Latino, they were bilingual and able to

communicate with the large proportion of Spanish speaking patients. They were able to translate the potentially confusing and complicated medical aspects of their care, into both Spanish and lay language. They understood the influence of Latino culture on the patients' lives, which they could then relay to the health professionals. Here a coordinator is discussing the personal qualities that they felt were necessary to carry out their role, illustrating their investment in the care of their patients:

> …you need to find a connection within your heart, ((pause)) and within yourself, to be able to understand the community, to be able to humble yourself, 'cos a lot of these people can either come from really wealthy families, or ((pause)) be homeless. So, regardless of who the person is, we find a way to communicate, and connect with them. Because that's the only way that they're going to be, ((pause)) willing to make changes in their life…we can train the brain, but we cannot train the heart…So we need to find someone (a care coordinator) that has that passion to help their community. Especially the Hispanic community because, we have a lot of, um, around in Pomona, so we really need someone that understands their culture. (Care Co-ordinators).

The care coordinators also chaired the weekly MDT meeting, an example of the task shifting Professor Pumerantz employed. As many of the providers attend this meeting as possible, during which they look at each of the new patients who have attended that week. Although the patient does not personally attend this meeting, their personal goals are incorporated into the shared care planning facilitated by the care coordinators, who liaise with the MDT members constantly over the long term management of the patient, ensuring the patient's wishes are valued.

- *Organisation of care: sole information technology (IT) platform, sole disease index*

Diabetes care, like other chronic diseases, is often hindered, by multiple providers using multiple IT systems. Professor Pumerantz utilised a single IT platform, called ClickMedix, to facilitate communication between the MDT and the patient's family physician (ClickMedix 2018); and the WDI copyrighted the DXDI, literally made it possible for everyone to 'sing from the same song sheet'. The DXDI (Appendix 4) is a single page summary of the patient's condition, showing their diabetes trajectory from initial appointment to present day. It is a useful communication aid, using colour and scale to illustrate in a concise but simple way, how the patient is doing. The concept of DXDI, married with the way that some conditions were assessed and measured, works better for some than for others. For example, blood pressure or cholesterol, even podiatry fitted into the 5 scale index; but the dental index as originally specified (Appendix 4) was overly simplistic and tended to over report the oral

impact on glycaemic control. Professor Pumerantz and his team have since formulated an updated index for dental assessment (Appendix 5) (Pumerantz *et al.* 2017).

- *Organisation of Care Summary*

In summary, there are numerous key features to the WDI diabetes care pathway. Patient centred care is also key to the 2013 NHS England initiative, Year of Care (previously described) with the HCPs encouraged to adopt a 'health coach' approach to their consultations (National Health Service 2007). The use of MDTs in the management of complex chronic conditions such as diabetes is also not new; although in primary care in the UK, the MDT may consist of a PN, phlebotomist and a GP. The 'one stop shop' design for MDT diabetes management, where all the members of the MDT (including dieticians and podiatrists) are available in the same building at the same time, is provided in only some areas of the UK, and as such not all patients are able to benefit from it. The DXDI, albeit modified to a Scottish population (cardiology echocardiograms and dental components removed), is utilised in Ninewells Hospital Diabetes Centre, Tayside; where they also have a single IT platform for diabetes healthcare teams (Scottish Care Information-Diabetes Collaboration 2018) and patients (NHS Scotland 2018a). There is one element however, that is undoubtedly unique and the reason for the case study, and that was the inclusion of a dental component to the pathway. The drivers of change that have been responsible for this and the development of WDI are explored below.

3.3.2 Drivers of change

The key organisational features of the WDI diabetes care pathway outlined above were implemented over time and the drivers of change are proposed below.

- *University ethos*

WDI is part of Western University of Health Sciences. The university was founded in 1977 primarily as a college of medicine offering degrees in osteopathic medicine. The expansion of the university started in 2003 with the creation of the college of veterinary medicine; and was followed by colleges of dental medicine, optometry, podiatric medicine and pharmacy. The university teaching is still entrenched in the philosophy of osteopathic medicine: 'disease rarely occurs in isolation, nothing is treated in isolation and everything is interconnected'.

- *Charismatic leader*

WDI is the vision and product of the charismatic leader, Professor Pumerantz. He felt that the current delivery of diabetes care was flawed and embarked upon redefining it, calling for

'value' based care; care that is valued by patients and healthcare providers. He believed that historically healthcare was funded by a model of reimbursement, which attempts to rectify deficit by increasing the number of patients seen, hence a 'volume' based care system. However, more patients mean shorter consultations, which diminishes the potential for effective care delivery; a disappointment felt by both patient and provider. He had a long term goal, the 'triple aim', which was to improve patient experience, reduce costs and improve the health of the population. Here, Professor Pumerantz is referring to the fact that being aligned to a teaching institution provided the opportunity to do something different.

> …Ok, we're the university, it's a non-profit university, let's, um, we're supposed to be, you know, figuring out how we do things better, ((pause)) um, not just trying to compete with people who are doing the same thing. We want to do something completely different…I had a vision in mind… what I wanted to ah, create… I knew I was building something that was completely different and that, I myself had never experienced … (Professor Pumerantz, Executive Director and founder of WDI)

Diabetes, like other long term conditions, is managed mainly in primary care both in the US and UK. Professor Pumerantz reflected during his interview that his undergraduate experience of diabetes was linked to very poorly hospital patients suffering from the effects of end stage disease. This did not prepare him for looking after patients living with diabetes in primary care and he felt it was important to improve education and student understanding of this highly complex disease.

- *Commissioning*

The US commissioning of healthcare is done through medical insurance. The introduction of the Affordable Care Act (2010) created an opportunity for the people of Pomona, with its 70% Latino population, to have insurance and access to WDI. Persistent negotiation with insurance companies and the adaptation to a bundled system, enabled both medical and dental insurance to come to an agreement. Normally medical insurers do not underwrite dental care. In addition to this, despite having created a unique diabetes care model, there were no data to prove that it would actually produce better patient outcomes. WDI was also incredibly expensive, as there were so many providers in the MDT, so it took tenacious negotiation to get the insurers to eventually agree to a pilot trial. They initially agreed to refer a cohort of 10 patients to WDI, which was extended to 100. The data from this unique experiment, now provide evidence that supports and promotes the care that WDI offers (Pumerantz *et al.* 2017).

3.3.3 Relevance of USA case study to UK management of diabetes

In the UK, although there are some one-stop-shops for diabetes, the patient frequently has to travel to different providers for retinal scans, podiatry, dietetics, structured education programmes; and oral health screening is not commissioned as part of diabetes management. Some practices have a two tiered approach with tests performed by the HCA followed by review of the results with the diabetes nurse or GP. It may not be possible to commission a care coordinator to diabetes teams like in WDI, but possibly a 'light touch' version of that role could be adopted by someone like the HCA or health coach, acting as a go-between the patient and professionals, communicating in lay language about the results and organising who the patient should see next. The use of IT in healthcare services (ehealth) has been studied internationally to evaluate its potential for improving the efficiency and quality of healthcare (World Health Organisation 2018a); and whilst electronic health records are considered contemporaneous, safe and good for the environment, the implementation of ehealth can be problematic (Scantlebury *et al.* 2017).

Finally, the inclusion of a DHT into the MDT at WDI seemed to work well in raising the issue of oral health in the context of overall general health and, in particular, diabetes management and self-care. The inclusion of a DHT into the diabetes care team in the UK is a concept which will be explored further throughout the thesis, in the context of developing oral health interventions to improve communication between medical and dental professionals, and people with diabetes. Intervention development and implementation in healthcare requires careful consideration, planning and evaluation, such as described in the following Medical Research Council (MRC) framework.

3.4 Intervention development and evaluation model

Delivery of effective healthcare in a cost efficient manner is a global concern and necessitates the need for the continual evaluation and modification of services according to current evidence. The implementation of evidence-based practice was initially empirically driven and seemingly simple healthcare interventions comprise a number of separate elements essential to the intervention which makes evaluation in terms of identification, development, documenting and reproducing complex. Furthermore, the best designed interventions may not automatically lead to successful implementation. In order to facilitate more efficient design and evaluation of interventions, the MRC published a framework to guide researchers through intervention development and evaluation in 2000, which advised on a step-wise approach to determine the 'active ingredients' of the intervention at any given time (Campbell *et al.*

2000). The framework suggests a pre-clinical exploration of theory to identify elements that will ensure the most appropriate choice of intervention design. This design phase is followed by a modelling phase, exploratory trial, definitive RCT and then long term implementation (with systematic evaluation).

The framework was revised in line with evidence suggesting greater attention should be paid to piloting and development work (Hardeman *et al.* 2005) and a new flow chart replaced the original linear model (Figure 3.1)(Campbell *et al.* 2007). The development phase suggests reviewing existing evidence if there is any, before developing a theoretical understanding as a rational for the intervention. This should be followed by a process of modelling through a series of studies to refine the intervention, before embarking on full scale evaluation.

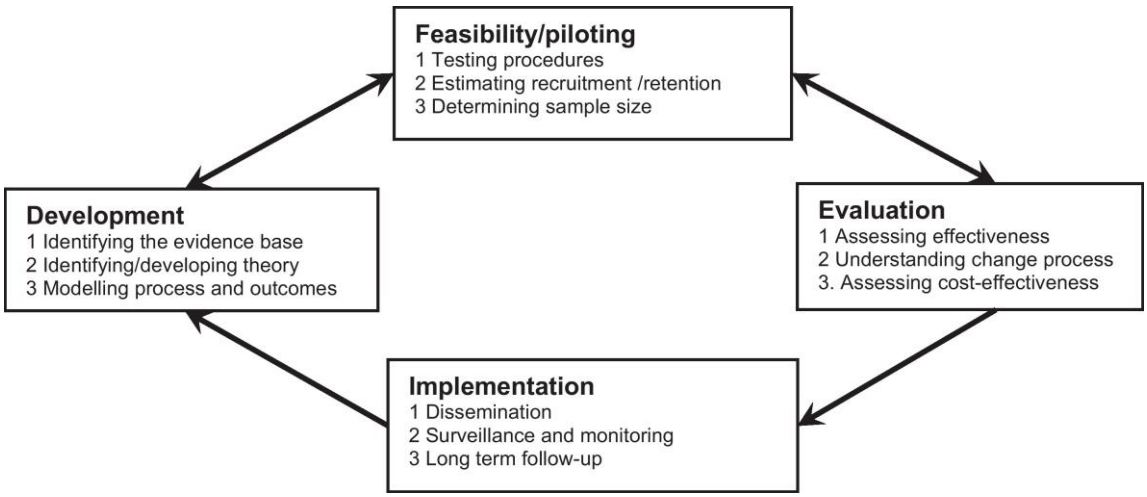

Figure 3.1 Key elements of the development and evaluation of complex interventions.

Adopting a theoretical approach to intervention development and implementation is challenging due to the large number of implementation models, theories and frameworks; and many have overlapping constructs. Furthermore, implementation research has adopted disciplines such as psychology, sociology and organisational theory to enable understanding of implementation determinants.

3.5 Implementation theories

Nilsen proposed three aims of the use of theoretical approaches in implementation science which are central to designing systems which are fit for purpose: to guide the process of

translating evidence into practice; to explain the influences on implementation outcomes; and evaluate the implementation (Nilsen 2015). Furthermore, a taxonomy of five categories of theoretical approaches were proposed to facilitate selection and application of approaches to implementation studies (Table 3.2). Notwithstanding, there is considerable overlap to the theories and when exploring the world of behavioural and implementation science as a novice, the use of interchangeable terms, such as knowledge transfer, knowledge exchange, knowledge translation, adds to the complexity.

Table 3.2 Five categories of theoretical approaches adapted from Nilsen (Nilsen 2015)

Category	Description	Example
Process models	Guide the process of translating of evidence into practice	The K2A Framework (Wilson *et al.* 2011)
Determinant frameworks	Explain the influences on implementation outcomes	Theoretical domains framework (TDF) (Rogers 1995)
Classic theories	Originating from disciplines external to implementation science, e.g. psychology, sociology and organisational theory.	Social Cognitive Theory (SCT) (Bandura 1986)
Implementation theories	Aid understanding and explain aspects of implementation	Normalisation Process Theory (NPT) (May and Finch 2009)
Evaluation frameworks	Explain aspects to determine successful implementation	Proctor et al framework (Proctor *et al.* 2011)

The following sections of this chapter will provide the context for implementation science with a brief description of the early behaviourists' work, before focusing on the theories that will provide an explanation of the influences on implementation outcomes. The intention is to focus on key models/theories which are considered most appropriate for the research in this thesis.

3.5.1 Early theories of human behaviour and learning

The term 'attitude' was used as a label in contemporary psychology literature exploring discriminatory, industrial, political, consumer and interpersonal behaviours (Fishbein and

Ajzen 1975). It was typically viewed as a latent variable that was assumed to influence behaviour and therefore it could be said to predispose an individual to behave in a certain way. 'Attitudes' were assumed to be learned, often from previous experience or actions, e.g. stimulus and action with either reward or punishment, shaped by environmental forces. This theory of learning, called 'operant conditioning', was initially developed from behaviourism pioneers (late 1800s to early 1900s), such as Ivan Pavlov, John Watson and Edward Thorndike, but was subsequently challenged for not taking into account cognitive processes. The term 'attitude' was eventually criticised for its ambiguity and there was uncertainty around how to measure and define it; hence, it became associated with conflicting results. Notwithstanding psychologists frequently considered 'attitude' to be a concept, and as such it became defined in relation to other constructs, such as, confidence, anxiety, intelligence, age and involvement. Whilst psychology-based behavioural theory can explain behaviour, it has also been shown to be a predictor of behaviour and has been used to develop interventions to enable behaviour change (Godin *et al.* 2008). A significant predictor means that work done on this psychological construct will increase the likelihood of this behaviour being carried out and is therefore frequently used in implementation research. These theories are categorised as classic theories (Nilsen 2015).

3.5.*2* *Classic theories – social cognition models to identify determinants of action*

Miller and Dollard 1941, published 'Social Learning and Imitation' (Miller and Dollard 1941). They recognised social modelling or 'observational learning', in which people's thought and behaviour was copied from behaviours exemplified by others. Social cognitive models of human behaviour refer to cognitions or thoughts as mental processes that operate between observable stimuli and responses of a HCP in real time.

- *Theory of Planned Behaviour*

Theory of Planned Behaviour (TPB) (an extension of the Theory of Reasoned Action (TRA)) (Fishbein and Ajzen 1975) proposed that behavioural intention is influenced by beliefs and subjective norms (or what is perceived as standard or typical), and personal agency (control) or 'the perceived ease or difficulty of performing the behaviour'(Ajzen 1985, Ajzen 1991). Perceived behavioural control is included as an additional determinant of intentions and behaviour, as it can work directly or indirectly through intention. It accounts for situations where people do not have a complete control over their behaviour. The TPB has been frequently used to predict health-related behaviour (Godin *et al.* 2008), however a systematic review in 2011 challenged the usefulness of the theory. It found that TPB was less predictive when used in studies with a longitudinal design and when outcome measures were objective

(as opposed to self-report) (McEachan *et al.* 2011). The suggestion has been made that TPB, whilst having contributed to the development of knowledge in behavioural research, has lost its utility in studies which aim to develop interventions (Sniehotta *et al.* 2014).

- *Social Cognitive Theory*

Social Cognitive Theory (SCT) is a theory of motivation and action which specifies how key determinants and governing mechanisms operate in concert in human self-development, adaptation and change (Bandura 1986). Although self-efficacy (belief in one's ability to accomplish a task) is pivotal to SCT, when used to elicit behaviour, SCT proposes three predictors of clinical behaviour: proximal goals (intention), self-efficacy and outcome expectations (belief of the consequences of the behaviour) (Bandura 1998). Self-efficacy and outcome expectations involve a self-evaluative element that is similar to TPB's attitude and subjective norm. Notwithstanding, although self-efficacy is central to SCT, it is closely related to personal agency (or control) and collective agency, involving the environment and organisations. In SCT there is an assumption that people will act in ways that they believe will lead to positive and valued outcomes, while avoiding behaviours that they expect to result in unfavourable outcomes. Self-efficacy not only has a direct influence on behaviour, but also operates through intentions (proximal goals), beliefs regarding the consequences of the behaviour (outcome expectations) and perceived socio-structural determinants; as shown in Figure 3.2 (Bandura 2009).

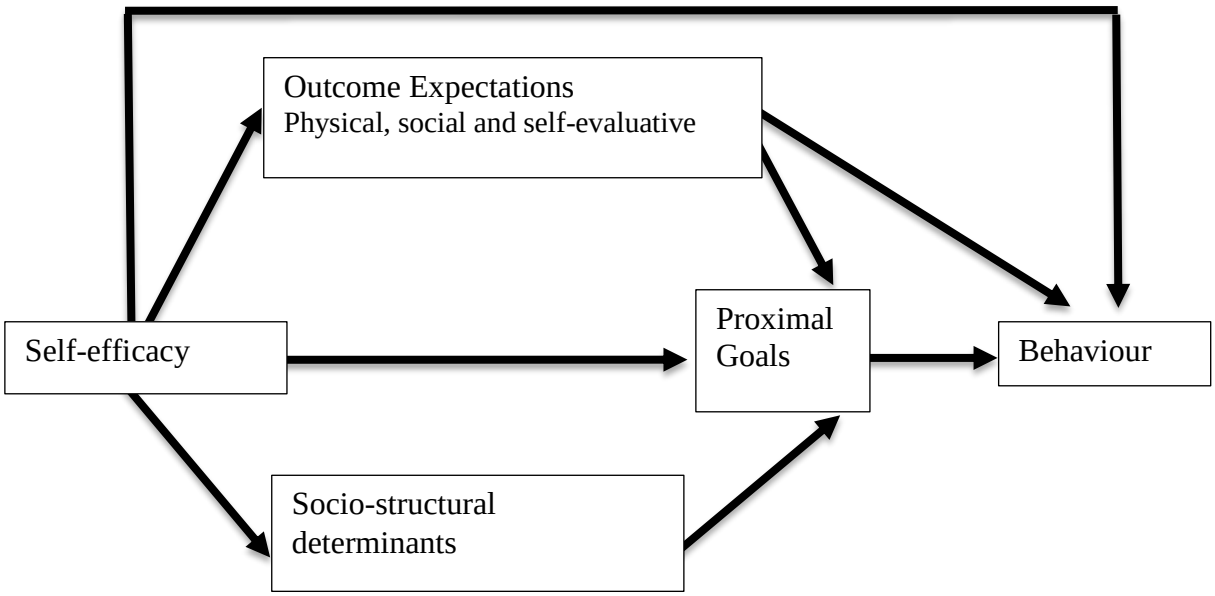

Figure 3.2 Social cognitive theory model showing associations between constructs and behaviour adapted from Bandura (Bandura 2009)

Godin et al used social cognitive theories to explore prediction of clinical-related behaviours and found intention was predictive, when the individual cognition processes involved reflection and active decision making (Godin *et al.* 2008). SCT has been widely used in studies to improve the uptake of physical activity and nutritional interventions (Stacey *et al.* 2015, Young *et al.* 2014). Clinical behaviour can involve decision making which is repetitive in nature and impulsive automatic processes operate in parallel with reflective motivational and volitional processes, which should be considered when designing interventions (Presseau *et al.* 2014b). Presseau et al, used multiple theories to look at prediction of six diabetes-related clinical behaviours and found that self-efficacy was predictive when testing SCT (Presseau *et al.* 2014b).

3.5.3 Determinant framework and implementation theories

Intervention work can be evaluated by exploring both the design of the intervention and the process by which it is implemented or incorporated into usual care. Early implementation work incorporated psychological theories of behaviour, and the use of these theories was secured with the work from Grol and Michie (Grol and Grimshaw 2003, Michie *et al.* 2005).

- *Theoretical Domains Framework*

The Theoretical Domains Framework (TDF) was developed (Michie *et al.* 2005) as an inter-disciplinary implementation taxonomy to enable increased uptake of evidence-based clinical behaviours. As a taxonomy, it is broad, incorporating 33 theories of behaviour and behaviour change arranged into 14 (originally 12) domains (Cane *et al.* 2012, Michie *et al.* 2005). TDF provides a theoretical lens through which to view cognitive (mental action/thoughts), affective (moods/feelings), social and environmental influences on behaviour. TDF has been used to gain understanding of health professional behaviour and changing patient behaviours in a range of clinical contexts such as stroke, increasing physical activity, loneliness in older adults. TDF is the theory of choice for many researchers as it offers a comprehensive range of potential influencers that may affect implementation. A systematic review of TDF is currently being undertaken (Presseau *et al.* 2018).

- *Normalisation Process Theory*

Normalisation Process Theory (NPT) developed in parallel with implementation science and the main statement of NPT was first published in 2009 (May and Finch 2009). It was developed from empirical studies rather than speculative theoretical constructions and is used to understand the agentic contribution from a social science perspective, focusing on phenomena (influences that affect action). The NPT framework is presented in Figure 3.3 and shows four core constructs: coherence, cognitive participation, collective action and reflexive monitoring. It enables researchers and practitioners to think through and measure the importance of elements of the implementation process by providing a theoretical framework to facilitate the interpretation of findings. NPT can be used both qualitatively and quantitatively to aid intervention development and implementation planning, as well as in evaluating and understanding implementation processes themselves (May *et al.* 2015). It also offers a set of conceptual tools to understand the dynamics of implementation within clinical trials.

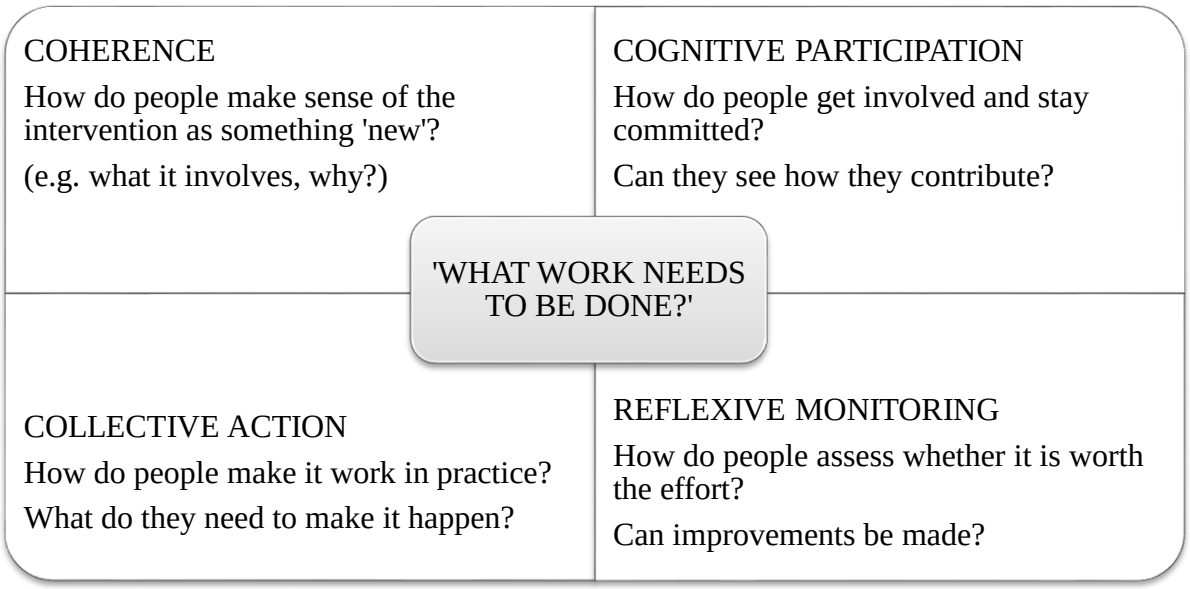

Figure 3.3 NPT framework, used to identify, conceptualize and evaluate the factors that promote or inhibit introduction, implementation and embedding of processes into normal care (May *et al.* 2007a)

Although NPT has been used diversely, the majority of studies have used NPT qualitatively in healthcare research. For early intervention design, coherence/sense-making is necessary with a degree of cognitive participation before collective action/implementation process can take place (Finch 2008). Since NPT emerged, there have been two systematic reviews (May *et al.* 2018, McEvoy *et al.* 2014). NPT appears to be popular with clinical researchers as it provides a conceptual vocabulary for implementation processes; and enables the identification and explanation of empirically identifiable mechanisms that motivate and shape implementation processes.

3.6 Novel combination of SCT and NPT

Although research has been done using multiple behaviour theories in a diabetes context before (Eccles *et al.* 2009, Eccles *et al.* 2011), the survey work (Chapters 4 and 5) was the first to combine SCT and NPT. A strength of SCT is that it can be used to generalise concepts to allow comparison of findings across different groups (Presseau *et al.* 2014a). It has been used for decades in the prediction of clinical behaviours; and has previously been combined with other theories in the context of diabetes with positive outcomes. Previous research indicated that whilst a lack of knowledge was a problem for medical professionals in the

context of diabetes and periodontitis, there were additional behavioural and organisational barriers that would hinder the implementation of oral health interventions (Bissett *et al.* 2013). Both theories are able to identify socio-determinants that would inform intervention design but offer different and complementary perspectives, as SCT is derived from a psychology discipline and NPT examines phenomena from a sociology perspective. Furthermore, although NPT is still a relatively new theory, it is supported by two systematic reviews and enables the conceptualisation of a broad range of factors that would determine implementation into normal clinical care. It was considered that the use of both theories would give added value in identifying SCT elements which could predict behaviours, whilst exploring elements of NPT which would improve the implementation process.

3.7 Summary

Glycaemic control is key in determining the risk of developing diabetes complications (Tsai *et al.* 2002) and periodontal treatment has the potential to significantly reduce HbA1c (Simpson *et al.* 2010, Simpson *et al.* 2015). Inter-professional collaboration between medical and dental professionals in the context of diabetes and periodontitis management has been recommended in numerous published guidance documents (Table 3.1); and integrated care worked successfully in WDI, where each member of the MDT recognised the oral-systemic connection. A theoretical approach to implementation science is central to developing systems which are fit for purpose (Nilsen 2015); and development and piloting work is recommended by the MRC (Campbell *et al.* 2007, Hardeman *et al.* 2005). Finally, the combination of SCT and NPT would offer a novel theoretical approach to the survey work, as shown in the following two chapters.

Chapter 4

Chapter 4: Identifying behavioural and organisational correlates of primary care medical professional clinical behaviours in the context of diabetes and periodontitis

4.1 Background

Delays in translating research findings into clinical practice and operational silos hindering inter-professional working are well documented (Eccles *et al.* 2005, Thomas 2006). Primary care medical teams likely lack knowledge about the links between diabetes and periodontitis, the dental complications of diabetes, and recommended management thereof, in part because they are not currently featured in UK NICE guidelines for diabetes, nor the guidelines of Scottish Intercollegiate Guidelines Network (SIGN), Diabetes Australia or American Diabetes Association (ADA). Notwithstanding, previous qualitative research exploring the management of periodontitis within the context of diabetes indicated that although knowledge of the bidirectional relationship between the diseases was important, organisational and behavioural barriers existed that could negatively impact management of both conditions (Bissett *et al.* 2013). Indeed, while fundamental, awareness of evidence alone is not sufficient to guarantee any practice change (Larme and Pugh 2001) and there is therefore a need to better understand factors associated with evidence-based oral healthcare in primary care.

This study aimed to explore primary care medical professionals' practices in relation to periodontal and diabetes care; and to ascertain, behavioural and organisational correlates of behaviour in this context to inform the 'who, what and when' of an oral health intervention.

4.2 Methods

4.2.1 Study design

The study used a cross-sectional design, involving online questionnaires (Appendix 6) to assess self-reported views on, and performance of, two specific clinical behaviours by primary care-based medical professionals, which are recommended in guidance documents to prevent and manage periodontitis in patients with diabetes (Table 3.1) (Chapple and Genco 2013, International Diabetes Federation 2009). These documents advise medical professionals to enquire annually regarding oral self-care and symptoms of periodontitis; inform about the links between diabetes and periodontitis; and advise to go to GDP regularly. The two clinical behaviours included in the questionnaire were:

1. *Informing* patients with diabetes about the links between diabetes and periodontitis
2. *Suggesting* patients with poorly controlled diabetes go for a dental check-up

Each behaviour was specified using the 'TACT-A' principle, which is a systematic method recommended by social cognition models of behaviour to specify behaviour for the purpose of predictive studies (Fishbein and Ajzen 2010). In broad terms, the target (T) is patients with diabetes; the actor (A) is the primary care clinician; the action (A) is the clinician's behaviour; the context (C) is primary or secondary care; and the time (T) is during a clinical interaction. As the questionnaire assessed two different behaviours, the Actor, Target, Context and Time were held constant whilst the Action varied between each behaviour (*informing* and *suggesting*).

4.2.2 Recruitment and data collection

Participants invited to complete the questionnaire included medical professionals working in primary and secondary care services involved in the care of patients with diabetes. Participants were recruited via the Clinical Research Network (CRN), specifically North East and North Cumbria (NENC) CRN and South West Peninsula (SWP) CRN. A network facilitator approached medical teams and gave them a study summary (Appendix 7) to consider. Expressions of interest were forwarded by email to the researcher and a telephone call was scheduled to obtain a contact list of the staff members who manage patients with diabetes. An email invitation with a link to the questionnaire was then sent to each staff member. Respondents were given five weeks to complete and submit the questionnaire. During this time two electronic reminders were sent as these have been shown to improve response (Clark *et al.* 2015): one at three weeks following the initial invitation, and the other after four weeks, thus reminding the respondent that there was only one week left before the close of the questionnaire. Completion and submission of the questionnaire was incentivised at half of their professional hourly salary, given the typical completion duration established during the pilot phase. The questionnaire responses were anonymous. A sample size target of n=150 was set *a priori*, consistent with thresholds suggested in systematic reviews of studies using constructs from behaviour theories to predict medical professional behaviour (Godin *et al.* 2008, Rashidian *et al.* 2006). The recruitment period ran from January to October 2016.

4.2.3 Measures

- Instrument development process

A questionnaire was developed to assess demographics, self-reported past behaviour and constructs from SCT (Bandura 1986, Bandura 1998, Bandura 2009) and NPT (Finch *et al.* 2013) (Table 4.1).

As knowledge can influence cognitions towards behaviours, potentially a lack of it could do the same, creating response bias (Bandura 1997). In order to minimise bias, background information referencing the bidirectional relationship between diabetes and periodontitis and the study aim were randomised, so that 50% the respondents would have been provided with this information, whereas the other 50% were not (Appendix 6). The questionnaire was piloted by two medical professionals using a 'think aloud' method to identify any ambiguities, observe ease of navigation and assess how long the questionnaire took to complete. It was then tested by a further five research staff to assess the functionality of the e-questionnaire software (Qualtrics 2017), to ensure accessibility via a link within an email, and to ensure that respondents were able to save and continue completion of the questionnaire at a later time prior to submission.

- *Demographic measures*

Participants were asked a series of demographic questions: sex; job role; age; year of most recent professional qualification; and how many patients with diabetes per month they typically see.

- *Past behaviour*

Two separate items assessed past behaviour by asking for how many of the previous 10 patients with diabetes had each of the two behaviours been carried out. Each measure was a dependent variable, being used as a proxy for future behaviour, and was dichotomised ('0 = no behaviour', '1= behaviour') for statistical regression analyses.

- *Measures of constructs from Social Cognitive Theory*

The questionnaire used different measures for each of the constructs. Self-efficacy was measured using 12 items on a five point Likert scale: '1-strongly disagree', '2-disagree', '3-neither agree nor disagree', '4-agree' and '5-strongly agree'. Items were informed by previous qualitative exploration of the determinants involved in carrying out behaviours in the context of diabetes and periodontitis (Bissett et al. 2013). Outcome expectation was measured using two items, on a five point Likert scale: 'will [the behaviour] be a good use of my time', from '1-not at all', '2-a little', '3-moderately', '4-quite a bit' and '5-extremely'; and 'will [the behaviour] help my patient', from '1-never', '2-rarely', '3-sometimes', '4-often' and '5-all of the time'. Proximal goals were assessed by asking 'how many of your next 10 patients do you intend to [the behaviour]' and assessed on a 10-point scale.

Table 4.1 Definitions of SCT and NPT constructs.

Normalisation Process Theory (NPT) constructs	
Coherence	How people make sense of the behaviour or intervention. What it involves and why?
Cognitive Participation	How people get involved and stay committed. Can they see how they contribute?
Collective Action	How people make it work in practice. What do they need to make it happen?
Reflexive Monitoring	How people assess whether it is worth the effort. Can improvements be made?
Social Cognitive Theory (SCT) constructs affected by socio-structural determinants.	
Self-efficacy	One's belief in one's ability to succeed in specific situations or accomplish a task.
Outcome Expectations	One's expectations about the consequences of an action.
Proximal Goals	One's intention (motivation) that regulates future effort and action.

Table adapted from NPT (May and Finch 2009) and SCT (Bandura 1986)

- *Measures of sub-constructs from Normalisation Process Theory*

NPT includes up to 16 sub-constructs, which can be selected depending of the stage of the intervention development. For early intervention design coherence is necessary with a degree of cognitive participation before collective action/implementation process can take place. Previous qualitative findings indicated a lack of understanding of what was being asked of the individual/team in the context of diabetes and periodontitis, and issues relating to normative values of professional role. These determinants informed the choice of five relative coherence and cognitive participation items (Table 4.2): coherence (differentiation, individual specification, communal specification and internalisation) and cognitive participation (legitimation) (Bissett *et al.* 2013, Finch 2008). The statement format was informed by the NPT implementation measure instrument, with the appropriate behaviours inserted as directed by the authors (May *et al.* 2015); and measured by a five point Likert scale: '1-strongly disagree' to '5-strongly agree' (as above); and three additional response options which offered alternative categories indicating lack of relevance:'6-not relevant to my role', '7-not relevant at this stage' and '8-not relevant to diabetes care'.

Table 4.2 Five NPT items utilised in the survey work

Item (sub-construct)	Description
Differentiation	I can see how the (behaviour) differs from usual ways of working.
Communal specification	Staff in this organisation have a shared understanding of the purpose of this (behaviour).
Individual specification	I understand how the (behaviour) affects the nature of my own work.
Internalisation	I can see the potential value of the (behaviour) for my work.
Legitimation	I believe that participating in the (behaviour) is a legitimate part of my role.

Table adapted from May (May *et al.* 2015).

- *Measures for the timing of the behaviours.*

The timing of the behaviours was measured using 11 items consisting of clinical scenarios which a patient with diabetes and periodontitis may encounter, including time of diagnosis and time of clinical condition worsening. Respondents were able to pick 'never' or multiple items from the list.

- *Measures for who could/should carry out the behaviours*

The HCP best suited to conduct the behaviours (in the opinion of the respondents) was measured using nine items consisting of dental clinicians and medical professionals from a multidisciplinary diabetes care team. The respondents were asked: who 'could' conduct the behaviours and who 'should' conduct the behaviours, to explore normative beliefs regarding professional role. Respondents were able to pick 'no one' or multiple items from the list.

4.2.4 Statistical analyses

IBM SPSS v23 was used to progressively analyse the questionnaire data. Initially, histograms were used to explore distributions and to visually assess normality and skewness. Kolmogorov-Smirnov assessment of normality was carried out and identified that all the data were significantly non-normal, thus non-parametric analyses were used throughout.

For the descriptive analyses, mean and standard deviation, and median and interquartile range (IQR) were calculated. Past behaviour, proximal goals and the NPT sub-constructs were single item. Self-efficacy was a 12 item construct, so internal consistency was calculated. Items for *informing* the patient about the links between the diseases were highly consistent (Cronbach's $\alpha > 0.93$) and *suggesting* patients with poorly controlled diabetes go for a dental check-up were likewise (Cronbach's $\alpha > 0.96$); therefore the multi-item scale was combined to form an overall mean construct score (Cohen 1992, Cronbach 1951). Outcome expectations were assessed using two-items. Items for *informing* the patient about the links between the diseases were correlated (Spearman's correlation = 0.51); and *suggesting* patients with poorly controlled diabetes go for a dental check-up were likewise correlated (Spearman's correlation 0.47), therefore the two-item scale was combined to form an overall mean construct score.

The Kruskal Wallis test, a rank-based non-parametric version of the one-way ANOVA, was used to assess whether there were significant differences between the three professional groups GPs, nurses and HCAs for past behaviour, the three SCT constructs and the five NPT sub-constructs. In situations where significant differences were found between groups, the Mann Whitney test was used *post-hoc* to compare the differences between pairs of (independent) professional groups in sequence, to identify where the significant differences lay, with a 3-way adjustment for the critical value of p. The critical value of p for determining statistical significance was thus set at 0.05 in general, but at 0.0167 for the post-hoc comparisons between professional groups.

To assess the relationship between SCT constructs and each of the two behaviours, Spearman's rank bivariate correlation analyses were initially ran. The SCT constructs were then explored in univariate regression analyses, before being combined within the multivariate logistical regression model consistent with tenets of SCT (Bandura 2009, Godin *et al.* 2008, Rashidian *et al.* 2006). Three covariates were selected to be entered at step one of the regression: background (information provided to the respondents as per the randomisation) or no-background; job role, specifically whether a prescriber or non-prescriber; and the self-reported number of patients with diabetes seen per month. Three covariates were not used in the combined model: sex was not associated with any SCT constructs in univariate analysis; age was not used as it was in the form of categorical data; and year of most recent professional qualification was not used as it was not relevant to HCAs who operate via clinical competencies. Measures of self-efficacy, outcome expectations and proximal goals were entered at step two of the regression.

4.2.5 Qualitative analyses

Two free text qualitative fields were included in the survey at the end of sections one and two, for 'any other comments'. Thematic analysis (Braun and Clarke 2006) was used to identify common attributes within the data as it is used in a broad range of disciplines (Rapley 2011). Notable discussion points and specific comments of interest were noted and codes or key words were applied. Emergent patterns and resultant themes were formulated via an inductive approach to the data analysis. Quotes which illustrated concepts relating to a particular theme were considered in detail and unpacked to explore meaning and develop better understanding. Analytical discussion during research meetings with supervisors provided the opportunity to further explore and clarify the emergent themes.

4.2.6 Regulatory approvals

A favourable opinion from an ethics committee was obtained from North West – Greater Manchester West Research Ethics Committee (REC# 16/NW/0030). Research and development (R&D) governance approval was granted by Newcastle upon Tyne Hospitals Foundation Trust, who acted as sponsor for the research (R&D# 07394). The project was registered on the NENC and SWP CRN portfolio (Portfolio# 20477).

4.3 Results

- Response rate and missing data

The contact details of 46 medical practices were forwarded to the researcher by CRN facilitators: 11 from NENC CRN and 35 from SWP CRN. Of these, a total of 37 practices took part in the study: 10 from NENC and 27 from SWP. 176 questionnaires were returned in total from 217 that were sent out (81% response rate). Of those 176 questionnaires, 11 had >10% of data missing. Analysis was carried out to compare the 100% completed questionnaires to the <100% completed questionnaires. There were no significant differences between the fully and partially completed questionnaires for gender, age or job role. The partially completed questionnaires comprised 6% of the overall sample and were deleted list-wise. The final sample was therefore n=165: comprising 96 GPs, 48 nurses and 21 HCAs.

- Practice level characteristics

Table 4.3 shows the practice sociodemographic data. The list size of the practices ranged from 3,600 to 35,818. Nineteen (51.4%) practices identified themselves as deriving their patients from both rural and urban communities and 11 (29.7%) practices purely from rural locations. The mean percentage of patients >65 years was 22.47 ± 6.44%, compared

to the national average of 17.8% (Office for National Statistics 2017). The mean percentage of patients diagnosed with either type 1 or type 2 diabetes was 6.3 ± 2.39%, which was consistent with the UK average of 6% (Diabetes.co.uk).

- *Sample characteristics*

The sample sociodemographic data are also shown in Table 4.3. One hundred and nineteen (72.1%) of the sample were women; and 114 (69.1%) were within the 40-60 years age bracket, with the remainder generally younger. HCAs saw a greater mean number of patients with diabetes per month (37.67 ± 40.68 patients), compared to GPs (33.20 ± 31.84 patients) and nurses (29.69 ± 25.99 patients), although the standard deviations were large. The mean number of years since the most recent qualification was attained was 12.64 ± 10.54 years.

Table 4.3 Practice and sample level characteristics: descriptive statistics of medical professional survey data (n=165)

Sociodemographic characteristics		
Practice level characteristics (n=37)		**Min-Max**
List size		3600 - 35818
		n (%)
Location	Urban	7 (18.9%)
	Rural	11 (29.7%)
	Mixed	19 (51.4%)
Practices with a separate diabetes clinic		25 (67.6%)
		Mean ± SD
% patient list >65 years		22.47% ± 6.44%
% patient list have diabetes diagnosis		6.3% ± 2.39%
Sample level characteristics (n=165)		**n (%)**
Sex	Female	119 (72.1%)
Age (years)	<30	5 (3.0%)
	30-40	39 (23.6%)
	40-50	58 (35.2%)
	50-60	56 (33.9%)
	>60	7 (4.2%)
		Mean ± SD
Years since last (prof) qualification		12.64 ± 10.54
Number of patients with diabetes seen per month	GP (n=96)	33.20 ± 31.84
	Nurse (n=48)	29.69 ± 25.99
	HCA (n=21)	37.67 ± 40.68

%, percentage; prof, professional; GP, doctor; HCA, healthcare assistant.

4.3.1 Descriptive analyses of past behaviour, SCT constructs and NPT items

Primary healthcare professionals' self-reported responses for the behaviour of informing patients about the links between diabetes and periodontitis

Table 4.4 shows descriptive statistics for SCT and NPT, together with past behaviour and results of significance testing of the differences between scores depending on the respondent job role, for *informing* patients about the links between diabetes and periodontitis.

- *Self-reported past behaviour*

All three professional groups reported *informing* less than one out of the last 10 of their patients about the links, with mean scores showing virtually no uptake (self-reported past behaviour) as evidenced by less than one out of the last 10 patients having been informed about the links. Based on this finding, it was considered appropriate to dichotomize this dependent variable (none of the last 10 patients informed dichotomized as zero, 1-10 of the last patients informed dichotomized as one) for all subsequent analyses.

- *Self-efficacy*

When ranking mean self-efficacy scores for each individual self-efficacy item, the barriers perceived to undermine their self-efficacy to inform patients most included 'it is not a priority for the patient' and 'I am running late', whereas the highest ranked item by all three professional groups was 'there are problems accessing dental services', with clinicians scoring positively that they would remain confident to *inform* patients despite this challenge (Table 4.5). As shown in Table 4.4, the GPs' mean self-efficacy score (2.82 ± 0.76) did not differ from that of HCAs scores (2.94 ± 0.82) but was statistically significantly lower than that of nurses (3.19 ± 0.76) (p=0.01).

Table 4.4 Descriptive statistics for *informing* patients about the links between diabetes and periodontitis (n=165)

Theoretical constructs	**GPs (n=96)** Mean ± SD Median (IQR) Min-Max	**Nurses (n=48)** Mean ± SD Median (IQR) Min-Max	**HCAs (n =21)** Mean ± SD Median (IQR) Min-Max	**p**
Past behaviour	0.23 ± 0.69 0 (0, 0) 0-5	0.58 ± 1.81 0 (0, 0) 0-5	0.24 ± 0.63 0 (0, 0) 0-2	0.95
Self-efficacy (SCT)	2.82 ± 0.76 2.92 (2.50, 3.22) 1-4.33	3.19 ± 0.76 3.12 (2.83, 3.71) 1-5	2.94 ± 0.82 3 (2.46, 3.42) 1-5	**0.04 (GP vs nurses 0.01)**
Outcome expectations (SCT)	3.10 ± 0.74 3 (2.50, 3.50) 1-5	3.54 ± 0.90 3 (3, 4) 2-5	3.38 ± 0.74 4.5 (4, 5) 3-5	**0.01 (GP vs nurses 0.01)**
Proximal goals (SCT)	7.60 ± 3.38 10 (5, 10) 0-10	7.94 ± 3.69 10 (5.75, 10) 0-10	4.29 ± 5.07 0 (0, 10) 0-10	**0.01 (GP vs HCAs 0.01) (Nurses vs HCAs 0.01)**
Coherence – differentiation (NPT)	4.06 ± 0.89 4 (4, 5) 1-5	3.91 ± 1.00 4 (4, 5) 1-5	3.67 ± 1.05 4 (3, 4) 2-5	0.29
Coherence - communal specification (NPT)	2.27 ± 0.83 2 (2, 3) 1-4	2.63 ± 1.09 3 (2, 3) 1-5	2.86 ± 1.10 3 (2, 4) 1-4	**0.03**
Coherence - individual specification (NPT)	3.40 ± 0.93 4 (3, 4) 1-5	3.30 ± 0.95 3 (3, 4) 1-5	3.07 ± 0.70 3 (3, 4) 2-4	0.25
Coherence – internalisation (NPT)	4.08 ± 0.66 4 (4, 5) 2-5	4.26 ± 0.61 4 (4, 5) 3-5	4.07 ± 0.59 4 (4, 4) 3-5	0.32
Cognitive participation – legitimation (NPT)	3.77 ± 0.76 4 (3, 4) 2-5	4.16 ± 0.71 4 (4, 5) 3-5	3.57 ± 0.65 3.5 (3, 4) 3-5	**0.01 (GP vs Nurses 0.01) (Nurses vs HCAs 0.01)**

Note: Past behaviour and proximal goals were 10 point scales; the other measures were five point Likert scales. *p* = test of differences *between* professional groups determined using Kruskal-Wallis (with post-hoc Mann Whitney tests and adjustment of critical value of p). GPs, general practitioners; HCAs, healthcare assistants; SCT, social cognitive theory; NPT, normalisation process theory. Statistically significant differences are indicated in bold font.

Table 4.5 Self-efficacy items for *informing* patients about the links between diabetes and periodontitis, ranked lowest to highest (n=165)

Self-efficacy items **I am confident that I can *inform* my patients with diabetes about the links between diabetes and periodontitis EVEN WHEN…**	**All groups (n=165) Mean ± SD**
… it is not a priority for the patient	2.74 ± 0.95
…I am running late	2.82 ± 1.06
…it is someone else's responsibility	2.82 ± 1.05
…there is already too much to do	2.85 ± 1.05
…it is not a priority for me	2.86 ± 0.96
…the patient has very few of their own teeth	2.91 ± 1.02
…work is busy	2.98 ± 1.11
…the patient has good dental health	2.99 ± 1.00
…I am not set up for it	3.05 ± 1.08
…my colleagues are not doing the same	3.05 ± 0.98
…my colleagues are doing the same	3.12 ± 0.97
…there are problems accessing dental services	3.14 ± 1.06

Note: means calculated from five point Likert scale, 1 (strongly disagree) to 5 (strongly agree)

- *Outcome expectations*

Means were higher across all professional groups for *informing* being a 'good use of time', and this was statistically significantly different to 'helping the patient' for GPs and nurses. As shown in Table 4.4, the GPs' mean score (3.10 ± 0.74) did not differ significantly from that of HCAs (3.38 ± 0.74), but was significantly lower than that of nurses (3.54 ± 0.90) (p=0.01).

- *Proximal goals*

The GPs' mean score (7.60 ± 3.38) did not differ significantly from that of nurses (7.94 ± 3.69), however, they were both statistically significantly higher than that of HCAs (4.29 ± 5.07) (p=0.01).

- *Coherence: differentiation*

The majority of responses (Table 4.4) were positive that informing patients about the links between diabetes and periodontitis differed from usual ways of working. The GPs' mean response (4.06 ± 0.89) did not differ from that of nurses (3.91 ± 1.00) or HCAs (3.67 ± 1.05).

- *Coherence: communal specification*

The second item states that 'staff in the organisation share understanding of the purpose of informing patients about the links'. Analysis indicated the HCAs' mean response score (2.86 ± 1.10) did not differ from that of nurses (2.63 ± 1.09) or GPs (2.27 ± 0.83).

- *Coherence: individual specification*

The next coherence item was a statement about understanding on an individual level: 'I understand how informing about the links affects the nature of my own work'. GPs (3.40 ± 0.93) did not differ from nurses (3.30 ± 0.95) or HCAs (3.07 ± 0.70).

- *Coherence: internalisation*

Responses to seeing the potential value of *informing* patients about the links were positive but the GPs' (4.08 ± 0.66) response did not differ from those of HCAs (4.07 ± 0.59) or nurses (4.26 ± 0.61).

- *Cognitive participation: legitimation*

The last cognitive participation item, 'I believe *informing* patients is a legitimate part of my role' was responded to positively. HCAs were the least positive (3.57 ± 0.65) and significantly different to nurses (4.16 ± 0.71), who scored statistically significantly higher than GPs (3.77 ± 0.76) (p=0.01).

Primary healthcare professionals' self-reported responses for the behaviour of suggesting patients with poorly controlled diabetes *go for a dental check-up*

Table 4.6 shows descriptive statistics for SCT and NPT, together with past behaviour and p values of the differences between scores depending on the respondent job role, for *suggesting* patients with poorly controlled diabetes go for a dental check-up.

- *Self-reported past behaviour*

All three professional groups reported *suggesting* patients with poorly controlled diabetes go for a dental check-up to less than one out of the last 10 of their patients, with mean and median scores showing little to no uptake (self-reported past behaviour).

- *Self-efficacy*

When ranking mean self-efficacy scores for each individual self-efficacy item, the barriers that undermined self-efficacy to inform patients most included 'it is not a priority for me/patient' and 'I am not set up for it', whereas the highest ranked item by all three professional groups was 'work being busy', with clinicians scoring positively that they would remain confident to *suggest* patients with poorly controlled diabetes go for a check-up despite this challenge (Table 4.7). As shown in Table 4.6, the GPs' mean self-efficacy score (3.17 ± 0.88) did not differ from that of HCAs (3.15 ± 0.71), but was statistically significantly lower than that of nurses (3.54 ± 0.78) (p=0.01).

Table 4.6 Descriptive statistics for *suggesting* patients with poorly controlled diabetes go for a dental check-up (n=165)

Theoretical constructs	**GPs (n=96)** Mean ± SD Median (IQR) Min-Max	**Nurses (n=48)** Mean ± SD Median (IQR) Min-Max	**HCAs (n =21)** Mean ± SD Median (IQR) Min-Max	**p**
Past behaviour	0.29 ± 0.71 0 (0, 0) 0-5	1.10 ± 2.46 0 (0, 1) 0-10	0.14 ± 0.48 0 (0, 0) 0-2	0.07
Self-efficacy (SCT)	3.17 ± 0.88 3.08 (2.77, 3.83) 1-5	3.54 ± 0.78 3.79 (3.02, 4) 1.45-5	3.15 ± 0.71 3 (2.79, 3.67) 2-5	**0.02 (GP vs nurses 0.01)**
Outcome expectations (SCT)	3.24 ± 0.80 3.50 (2.50, 4) 1-5	3.58 ± 0.88 3.50 (3, 4.5) 1.50-5	3.55 ± 0.82 3.50 (3, 4) 2-5	0.81
Proximal goals (SCT)	7.82 ± 3.28 10 (5, 10) 0-10	8.56 ± 3.12 10 (10, 10) 0-10	5.14 ± 5.04 8 (0, 10) 0-10	**0.00 (Nurses vs HCAs <0.001)**
Coherence – differentiation (NPT)	4.14 ± 0.63 4 (4, 5) 2-5	3.93 ± 1.10 4 (3.50, 5) 1-5	3.73 ± 0.88 4 (3, 4) 2-5	0.25
Coherence - communal specification (NPT)	2.38 ± 0.92 2 (2, 3) 1-4	2.84 ± 1.04 3 (2, 3.50) 1-5	3.27 ± 1.03 3 (3, 4) 1-5	**<0.001 (GPs vs Nurses 0.01) (GPs vs HCAs <0.001)**
Coherence - individual specification (NPT)	3.51 ± 0.86 4 (3, 4) 1-5	3.35 ± 0.90 3 (3, 4) 2-5	3.21 ± 0.70 3 (3, 4) 2-4	0.21
Coherence – internalisation (NPT)	4.06 ± 0.65 4 (4, 4) 2-5	4.24 ± 0.60 4 (4, 5) 3-5	3.87 ± 0.52 4 (4, 4) 3-5	0.085
Cognitive participation – legitimation (NPT)	3.75 ± 0.83 4 (3, 4) 1-5	4.13 ± 0.66 4 (4, 5) 3-5	3.62 ± 0.65 4 (3, 4) 3-5	**0.01 (GPs vs Nurses 0.01)**

Note: Past behaviour and proximal goals were 10 point scales; the other measures were 5 point Likert scales. *p* = test of differences *between* professional groups determined using Kruskal-Wallis (post-hoc Mann Whitney adjustment of critical value of p) GPs, general practitioners; HCAs, healthcare assistants; SCT, social cognitive theory; NPT, normalisation process theory. Statistically significant differences are indicated in bold font.

Table 4.7 Self-efficacy items for *suggesting* patients with poorly controlled diabetes go for a dental check-up, ranked lowest to highest (n =165)

Self-efficacy items **I am confident that I can provide a *suggestion* to go for a dental check-up EVEN WHEN…**	**All groups (n=165) Mean ± SD**
…it is not a priority for me	3.10 ± 1.07
…I am not set up for it	3.10 ± 1.05
… it is not a priority for the patient	3.13 ± 1.05
…there are problems accessing dental services	3.15 ± 1.06
…it is someone else's responsibility	3.25 ± 1.03
…I am running late	3.27 ± 1.00
…the patient has very few of their own teeth	3.30 ± 0.96
…there is already too much to do	3.31 ± 1.06
…my colleagues are not doing the same	3.35 ± 1.01
…the patient has good dental health	3.36 ± 1.00
…my colleagues are doing the same	3.39 ± 0.92
…work is busy	3.58 ± 0.96

Note: means calculated from five point Likert scale, 1 (strongly disagree) to 5 (strongly agree)

- *Outcome expectations*

Means were higher across all professional groups for *suggesting* being a 'good use of time', and this was statistically significantly different to 'helping the patient' for GPs and nurses. The GPs' mean score (3.24 ± 0.80) did not differ from that of HCAs (3.55 ± 0.82) or nurses (3.58 ± 0.88).

- *Proximal goals*

The responses for proximal goals/intention to *suggest* patients with poorly controlled diabetes go for a dental check-up were higher when compared to past behaviour. The GPs' mean score (7.82 ± 3.28) did not differ from that of nurses (8.56 ± 3.12), but the nurses' mean score was statistically significantly higher than that of HCAs (5.14 ± 5.04) ($p<0.001$).

- *Coherence: differentiation*

The majority of responses were positive, HCPs agreeing that suggesting that patients with poorly controlled diabetes should go for a dental check-up was not usual practice. There was no significant difference between the professional groups. The GPs' mean score (4.14 ± 0.63) did not differ from that of nurses (3.93 ± 1.10) or HCAs (3.73 ± 0.88).

- *Coherence: communal specification*

GPs' mean response score to 'staff in the organisation share understanding of the purpose of *suggesting'* (2.38 ± 0.92) was statistically significantly lower than that of nurses (2.84 ± 1.04) ($p=0.01$) and HCAs (3.27 ± 1.03) ($p<0.001$).

- *Coherence: individual specification*

There was no significant difference detected between GPs (3.51 ± 0.86), nurses (3.35 ± 0.90) and HCAs (3.21 ± 0.70).

- *Coherence: internalisation*

The nurses' mean score (4.24 ± 0.60) did not differ from those of GPs (4.06 ± 0.65) or HCAs (3.87 ± 0.52) for seeing the potential value of *suggesting* to go for a dental check-up.

- *Cognitive participation: legitimation*

The nurses' mean response score (4.13 ± 0.66) did not differ from that of HCAs (3.62 ± 0.65), but was statistically significantly higher than that of GPs (3.75 ± 0.83) ($p=0.01$) for believing *suggesting* patients go for a dental check-up was a legitimate part of their role.

Summary of the descriptive analysis for SCT and NPT for both behaviours

Based on self-reported HCPs' responses, there was little to no *informing* about the links between diabetes and periodontitis or *suggesting* that patients go for a dental check-up currently being carried out. Proximal goals/intention to carry out both behaviours were higher than past behaviours across all groups; with both GPs and nurses scoring statistically significantly higher than HCAs to *inform* their patients; and nurses scoring statistically significantly higher than HCAs to *suggest* that patients go for a dental check-up. For both behaviours, issues concerning priorities ranked highest as affecting confidence to perform the behaviours and both GPs and HCAs scored statistically significantly lower for self-efficacy than the nurses. GPs and HCAs also scored statistically significantly lower compared to nurses for outcome expectations for *informing*, although scores between professional groups did not differ for *suggesting*.

All professional groups agreed that both behaviours differed from usual ways of working, but also agreed on the potential value of the behaviours to their work. There was neither agreement nor disagreement to understanding how the behaviours affected their own work. There was a negative response from all professional groups to staff in their organisation understanding the purpose of informing about the links; but nurses' and HCAs' scores were both statistically significantly higher than those of GPs for suggesting to go for a dental check-up. Regarding legitimation, nurses scored statistically significantly higher than GPs for *informing* about the links; and statistically significantly higher than GPs and HCAs for *suggesting*.

4.3.2 Correlates of past behaviour and SCT constructs

SCT correlates for informing patients about the links between diabetes and periodontitis

Table 4.8 shows Spearman correlations for past behaviour, *informing* patients about the links between diabetes and periodontitis. The correlations were all weak and none of them were statistically significant: self-efficacy (0.03), outcome expectations (0.14), proximal goals (0.08).

Table 4.8 SCT correlates for *informing* patients about the links between diabetes and periodontitis (n=165)

	Past behaviour	Self-efficacy	Outcome expectations	Proximal goals
Past behaviour	-			
Self-efficacy	0.03	-		
Outcome expectations	0.14	0.13	-	
Proximal Goals	0.08	0.12	0.42**	-

**p<0.01; *p<0.05

SCT correlates for <u>suggesting</u> patients with poorly controlled diabetes go for a dental check-up

Table 4.9 shows Spearman correlations for past behaviour, *suggesting* patients with poorly controlled diabetes go for a dental check-up. The correlations were all weak and only self-efficacy was statistically significant (p<0.001): self-efficacy (0.21**), outcome expectations (0.04), proximal goals (-0.04).

Table 4.9 SCT correlates for *suggesting* patients with poorly controlled diabetes go for a dental check-up (n=165)

	Past behaviour	Self-efficacy	Outcome expectations	Proximal goals
Past behaviour	-			
Self-efficacy	0.21**	-		
Outcome expectations	0.04	0.09	-	
Proximal Goals	-0.04	0.30**	0.40*	-

**p<0.01; *p<0.05

4.3.3 Binary logistic regression analysis of past behaviour and SCT constructs

A hierarchical logistic regression was conducted to assess which SCT constructs predicted the HCPs' past behaviour in relation to diabetes and periodontal management. Past behaviour was used as a proxy for future behaviour, due to the questionnaire being cross-sectional in design, and was the dependent variable. At step one, the covariates of dichotomised background information provided/no background information provided; job role in the form of dichotomised prescriber/non-prescriber; and the number of patients with diabetes seen per month were entered into the model. At step two, the SCT constructs were entered initially in a univariate model (i.e. each in a separate analysis), followed by multivariate analysis which combined SCT constructs in the same model.

- Modelling SCT constructs as correlates of informing patients about the links between diabetes and periodontitis

The covariate of prescriber/non-prescriber ($\beta = -0.12$, $p = 0.80$) and number of patients with diabetes seen per month ($\beta = 0.00$, $p = 0.61$) had small regression coefficients and were not statistically significant, therefore they did not appear to be associated with the behaviour. Background information/no background information had a large standardised regression coefficient ($\beta = 1.03$; $p = 0.03$) and was statistically significant indicating that it does appear to be associated with *informing* patients about the links.

- SCT constructs as predictors of past behaviour informing about the links between diabetes and periodontitis

Table 4.10 shows the multivariate logistic regression model for *informing* patients with diabetes about the links between diabetes and periodontitis. The predictors for *informing* accounted for a small amount of variance (Cox & Snell R^2 0.05; and Nagelkerke R^2 0.09). Neither self-efficacy ($\beta = 0.07$, $p = 0.82$), outcome expectations ($\beta = 0.40$, $p = 0.21$) or proximal goals ($\beta = 0.09$, $p = 0.21$) were significant predictors in a model that controlled for demographic factors and included other SCT constructs.

Table 4.10 Multivariate logistic regression model predicting past *informing* patients with diabetes about the links between diabetes and periodontitis (n=165)

Predictors	*β*	*B*	*SE*	*p*	*95%* CI *B* Coefficient	
					Lower	Upper
Background_no background	1.03	2.81	0.47	**0.03**	1.11	7.10
Prescriber (n = 96)_non-prescriber (n = 69)	-0.12	0.89	0.48	0.80	0.35	2.27
Number of patients with diabetes seen per month	0.00	1.00	0.01	0.61	0.99	1.02
Self-efficacy	0.07	1.07	0.30	0.82	0.60	1.92
Outcome Expectation	0.40	1.49	0.32	0.21	0.80	2.79
Proximal Goals	0.09	1.10	0.07	0.21	0.95	1.27

Cox & Snell R^2 0.05, Nagelkerke R^2 0.09
R^2 variance; *β* standardised regression coefficient; *B* exponential of B (odds ratio); *SE* standard error; *p* test of difference (statistically significant differences are indicated in bold font); CI confidence interval.

Modelling SCT constructs as correlates of <u>suggesting</u> patients with poorly controlled diabetes go for a dental check-up

Table 4.11 shows the multivariate logistic regression model for *suggesting* patients with poorly controlled diabetes go for a dental check-up. None of the covariates were statistically significant. Background information/no background information (β = -0.89, p=0.13), prescriber/non-prescriber (β = -0.89, p = 0.13) and number of patients with diabetes seen per month (β = 0.01, p=0.19) had weak regression coefficients; and therefore did not appear to be associated with the behaviour.

- SCT constructs as predictors of past behaviour suggesting patients with poorly controlled diabetes go for a dental check-up

The predictors for *suggesting* the impact of treatment accounted for a small amount of variance (Cox & Snell R^2 0.04; and Nagelkerke R^2 0.07), and self-efficacy accounted for a statistically significant amount of variability (β = 0.54, p = 0.04). Outcome expectations (β = 0.06, p = 0.81) and proximal goals (β = -0.01, p = 0.90) were not statistically significant and therefore did not appear to be associated with the behaviour.

Table 4.11 Multivariate logistic regression model predicting past *suggesting* patients with poorly controlled diabetes go for a dental check-up (n=165)

Predictors	*β*	*B*	*SE*	*p*	*95%* CI *B* Coefficient	
					Lower	Upper
Background_no background	0.23	1.26	0.40	0.57	0.58	2.74
Prescriber (n =96)_non-prescriber (n = 69)	-0.03	0.97	0.41	0.95	0.44	2.15
Number of patients with diabetes seen per month	0.01	1.01	0.01	0.19	1.00	1.02
Self-efficacy	0.54	1.71	0.27	**0.04**	1.02	2.88
Outcome Expectation	0.06	1.06	0.26	0.81	0.64	1.75
Proximal Goals	-0.01	0.99	0.06	0.90	0.88	1.12

Cox & Snell R^2 0.04, Nagelkerke R^2 0.07
R^2 variance; *β* standardised regression coefficient; *B* exponential of B (odds ratio); *SE* standard error; *p* test of difference (statistically significant differences are indicated in bold font); CI confidence interval.

Summary of results using SCT to identify modifiable correlates of healthcare professionals' reported behaviours

The regression modelling for the two behaviours accounted for small amounts of variance. The covariate background information/no background information was associated with *informing* the patient about the links, being statistically significant and having a large standardised regression coefficient. No SCT constructs were statistically significant predictors

for *informing*. No covariates were statistically significantly associated with *suggesting*, however, self-efficacy was a statistically significant predictor.

4.3.4 Who could/who should, carry out the behaviours?

Who could/should inform the patient about the links between diabetes and periodontitis and suggest patients with poorly controlled diabetes go for a dental check-up?

The questionnaire asked respondents about who (indicating different categories of clinicians) could/should manage different aspects of inter-disciplinary care of patients with diabetes and periodontitis. Tables 4.12 and 4.13, show the list of medical and dental HCPs who are involved in the management of patients with diabetes that the respondents were presented with and the frequencies of responses for who could/should *inform* about the links between diabetes and periodontitis and *suggest* patients with poorly controlled diabetes go for a dental check-up, respectively. Generally, scores for 'could' were either equal to, or higher than, 'should'. GPs scored 'could' statistically significantly higher than 'should' for every professional apart from GDPs (and 'no-one'). Nurses only scored dieticians 'could' statistically significantly higher than 'should'; for HCAs, there were no differences between scores. The professional groups scored in a similar way to each other, particularly nurses and HCAs who both scored DSNs at the top for both behaviours. The GPs scored GDPs at the top and DSNs second; and themselves second last to dieticians for both behaviours.

Table 4.12 Who could/should *inform* the patient about the links between diabetes and periodontitis?

	GPs (n=96) N (%)		**p**	**Nurses (n=48)** N (%)		**p**	**HCAs (n =21)** N (%)		**p**
	could	should		could	should		could	should	
No-one	1 (1.0)	1 (1.0)	1.00	0 (0)	1 (2.1)	0.32	0 (0)	0 (0)	1.00
GP	80 (83.3)	62 (64.6)	**<0.001**	41 (85.4)	38 (79.2)	0.26	19 (90.5)	18 (85.7)	0.32
GPwSI	80 (83.3)	62 (64.6)	**<0.001**	40 (83.3)	40 (83.3)	1.00	19 (90.5)	18 (85.7)	0.32
Dietician	74 (77.1)	50 (52.1)	**<0.001**	38 (79.2)	31 (64.6)	**0.01**	14 (66.7)	13 (61.9)	0.32
Diabetologist	81 (84.4)	70 (72.9)	**<0.001**	40 (83.3)	40 (83.3)	1.00	16 (76.2)	16 (76.2)	1.00
GDP	94 (97.9)	92 (95.8)	0.32	44 (91.7)	43 (89.6)	0.56	20 (95.2)	19 (90.5)	0.32
DHT	89 (92.7)	80 (83.3)	**0.01**	42 (87.5)	38 (79.2)	0.05	16 (76.2)	16 (76.2)	1.00
DSN	92 (95.8)	84 (87.5)	**0.01**	46 (95.8)	44 (91.7)	0.16	21 (100)	21 (100)	1.00
Other	15 (15.6)	9 (9.4)	**0.01**	21 (43.8)	18 (37.5)	0.08	6 (28.6)	4 (19.0)	0.16

Note: *p* = test of differences between 'could' and 'should' determined using Wilcoxon Signed-Rank test. Statistically significant differences are indicated in bold font. GP, general practitioner; GPwSI, GP with special interest; GDP, general dental practitioner; DHT, dental hygienist and therapist; DSN, diabetes specialist nurse.

Table 4.13 Who could/should *suggest* patients with poorly controlled diabetes go for a dental check-up?

	GPs (n=96) N (%)		**p**	**Nurses (n=48)** N (%)		**p**	**HCAs (n =21)** N (%)		**p**
	could	should		could	should		could	should	
No-one	1 (1.0)	2 (2.1)	0.32	1 (2.1)	1 (2.1)	1.00	0 (0)	0 (0)	1.00
GP	81 (84.4)	66 (68.8)	**<0.001**	42 (87.5)	37 (77.1)	0.03	19 (90.5)	19 (90.5)	1.00
GPwSI	74 (77.1)	63 (65.6)	**0.01**	43 (86.6)	39 (81.3)	0.05	18 (85.7)	18 (85.7)	1.00
Dietician	70 (72.9)	51 (53.1)	**<0.001**	38 (79.2)	31 (64.6)	**0.01**	14 (66.7)	14 (66.7)	1.00
Diabetologist	79 (82.3)	71 (74.0)	**0.03**	41 (85.4)	40 (83.3)	0.66	16 (76.2)	17 (81.0)	0.32
GDP	84 (87.5)	81 (84.4)	0.37	37 (77.1)	37 (77.1)	1.00	15 (71.4)	14 (66.7)	0.32
DHT	82 (85.4)	73 (76.0)	**0.01**	39 (81.3)	36 (75.0)	0.18	13 (61.9)	12 (57.1)	0.32
DSN	89 (92.7)	84 (87.5)	0.10	46 (95.8)	45 (93.8)	0.32	21 (100)	21 (100)	1.00
Other	16 (16.7)	11 (11.5)	**0.03**	20 (41.7)	18 (37.5)	0.32	6 (28.6)	6 (28.6)	1.00

Note: *p* = test of differences between 'could' and 'should' determined using Wilcoxon Signed-Rank test. Statistically significant differences are indicated in bold font. GP, general practitioner; GPwSI, GP with special interest; GDP, general dental practitioner; DHT, dental hygienist and therapist; DSN, diabetes specialist nurse.

4.3.5 Timing of the behaviours

Table 4.14 presents the frequency statistics for self-reported responses from all respondents for the timing of (i.e. when best to conduct) the behaviours. For both *informing* (76.4%) and *suggesting* (70.3%), 'at time of diabetes diagnosis' was the highest ranked.

Table 4.14 Frequency statistics for timing options for the behaviours: 'when is it a good time to…' (n=165)

Timing options:	…*inform* patients about the links between diabetes and periodontitis? N (%)	… *suggest* patients with poorly controlled diabetes go for a dental check-up? N (%)
Never	4 (2.4%)	5 (3.0%)
At time of periodontal diagnosis	83 (50.3%)	79 (47.9%)
At time of diabetes diagnosis	**126 (76.4%)**	**116 (70.3%)**
At their routine check-up appointment	122 (73.9%)	76 (46.1%)
Alongside discussion regarding their HbA1c	125 (75.8%)	107 (64.8%)
When the patient has poorly controlled diabetes	118 (71.5%)	112 (67.9%)
When the patient is facing being prescribed oral medication (or additional oral medication) for their diabetes	88 (53.3%)	80 (48.5%)
When the patient is facing being put onto insulin or other injectables	79 (47.9%)	75 (45.5%)
At their first appointment in the practice	60 (36.4%)	55 (33.3%)
When the periodontal condition deteriorates	87 (52.7%)	94 (57.0%)
Other	12 (7.3%)	14 (8.5%)

Note: highest frequency for each behaviour in bold

4.3.6 Qualitative data from free text fields

Two free text qualitative fields were included in the survey at the end of sections one and two, for 'any other comments'. These were optional fields, so the respondent could leave them blank if they wished. The overall mean response rate was 66.1%, indicating that two thirds of the respondents opted to provide further context, explanation of responses or opinion.

Part one of the survey consisted of questions relating to sociodemographic data (see previous Section 4.2.3): sex; job role; age; year of most recent professional qualification; and how many patients with diabetes per month they typically see. The free text comments in this section generally related to the question which asked for the approximate number of patients with diabetes seen per month. The reasons for the difficulty surrounding this question varied, but generally providing an accurate response that truly reflected diabetes provision was problematic. For example, some GPs saw patients with a diagnosis of diabetes, but not necessarily for a reason related to their diabetes; often the diabetes reviews were carried out by nurses; and some respondents referred to seeing patients in mixed clinics, rather than in a chronic illness or specific diabetes review clinic.

The majority of comments in the questionnaire related to section two of the survey which consisted of the theory-based measures relating to the two behaviours (*informing* patients with diabetes about the links between diabetes and periodontitis, and *suggesting* patients with poorly controlled diabetes go for a dental check-up) (see Section 4.2.3): current (past) behaviour; SCT self-efficacy; SCT outcome expectations; the five NPT sub-constructs (coherence differentiation, communal and individual specification, and internalisation; and cognitive participation legitimation) and SCT intention (past behaviour). The qualitative data have been broadly categorised into 'Knowledge, skills and confidence' and 'Responsibility and role' themes.

- *Knowledge, skills and confidence*

Generally, the respondents did not know about the links between diabetes and periodontitis. Some respondents merely stated this as a fact; others added that they were grateful for the information; whilst others seemed affronted that this was not included in diabetes-related professional development. This nurse wanted to explain why she was not currently *informing* patients about the links or *suggesting* they get a check-up.

> I have not previously been aware of the connection between oral health and poorly controlled diabetes. It has never been mentioned at any diabetic course/learning event that I have attended and I have not read any diabetic articles in relation to this. As a

> result, I have never addressed this issue with any of my diabetic patients during a consultation. (Nurse)

Some respondents reported that their newly acquired knowledge would inform future practice. Furthermore, they suggested ways in which the behaviours could be incorporated into their local diabetes protocol, such as placing a leaflet into the pack of information that they give to newly diagnosed diabetes patients; informing the patients at their diabetes review appointments; and adding it to the diabetes 'template' (an electronic check list for reviewing diabetes) as a reminder. This GP described disseminating the information to the rest of their team.

> Before completing this survey, I was not aware of the link between poorly controlled diabetes and periodontitis, therefore this has been a very useful learning exercise for me-thank you! I will amend my practice accordingly, and share this information with my primary healthcare team. (GP)

Whilst the information was received graciously by most, there were respondents who felt that they would need more information about how diabetes and periodontitis were linked in order to *inform* their patients: "I don't know enough about the link myself to explain it to my patients yet" (Nurse). The following HCA assumed that the nurse in their diabetes care team would be more informed than they were, however they did not use this as an excuse, rather they suggested that they could carry out the behaviours in an informative but not explanatory way, leaving the nurse to explain further as necessary.

> I will seek to find out more information from the trained nurses but as a healthcare assistant I will now mention the link and suggest a visit to the dentist but also direct them to the trained diabetic nurse for more information as I don't feel qualified enough to be giving a full explanation to patients. (HCA)

In addition to the need for more information, there were other patient-related issues which created concerns relating to the behaviours, such as diabetes information overload and poor access to NHS GDPs. One respondent also appeared sceptical about what difference *informing* about the links and *suggesting* to go for a dental check-up would make, as they commented that those patients who do not attend the GDP probably will not engage with the advice: "there is usually a reason people don't attend their GDP regularly (they don't like going)", (GP).

- *Responsibility and role*

Although some respondents indicated that their newly acquired knowledge inspired them to change their practice, others were less enthusiastic. This GP, whilst acknowledging the new knowledge, wanted to stress the importance of self-management in diabetes management.

> Whilst this will be a new mind set, I think we also need to factor the patient and the responsibility they will have to take for this, as it is their diabetes, a long term condition that they live with 24/7, and whilst we can advise and assist they have to take ownership for this. (GP)

'The patient' was also mentioned by another GP, who somewhat defensively refused to change their practice, stating that it was not their business to interfere with the patient's dental health. It is unclear whether the reference to 'expertise' in the quote relates to a lack of knowledge or professional demarcation, but it suggests that *informing* about the links and *suggesting* to go for a dental check-up are not considered legitimate to this GP's role.

> As I am a GP I stick to my area of expertise - I leave patients to make up their own minds about how much mouth care they want to pursue. (GP)

The role of each HCP in the context of their local protocol for diabetes management was referred to frequently, with the respondent sometimes taking the time to justify who (if anyone) would be responsible for these behaviours in their team. In this next quote, the GP suggests that although they see patients with diabetes, their consultations tend to be about the complications associated with diabetes rather than glycaemic control *per se*, and, as such, it would not be the correct context for the behaviours.

> I very rarely see people who specifically attend due to diabetes, or to discuss diabetic control. Nearly always they have multiple other concerns. It may be part of the diabetic review appointment (nurse does), but unless the patient has an oral health problem, I am unlikely to be able to make time in a consultation which could very well be for multiple other problems such as gynaecology or prostate. You could get the information included in preliminary diabetic information leaflets, and reinforce at specific review appointments. (GP)

Notwithstanding, this GP suggested that the nurse in their team would be more appropriate as *informing* patients about the links and *suggesting* they get a check-up would align with discussion relating to diabetes review appointments that they carry out.

4.4 Discussion

This study aimed to investigate behaviours and identify behaviour determinants that may facilitate medical professional's uptake of clinical recommendations in relation to the management of periodontitis and diabetes. A theoretical approach was utilized (consistent with MRC guidance), including SCT and NPT, being the first time that these theories have been used together. Based on self-reported HCPs' responses, there was little to no *informing* of patients about the links between diabetes and periodontitis or *suggesting* that patients go for a dental check-up currently being conducted. Lack of knowledge of the evidence was clearly a factor and the randomisation of the presence of background information was statistically significant for *informing*. Notwithstanding, it was not statistically significant for *suggesting*, which may indicate that whilst providing the patient with health related information is routine, albeit new information, *suggesting* to go for a check-up, is less familiar. *Suggesting* may also be considered an indirect referral, which may need more consideration on the part of the HCP.

For both behaviours, issues concerning priorities ranked highest as affecting confidence to perform the behaviours, and both GPs and HCAs scored statistically significantly lower for self-efficacy and outcome expectations than nurses. Notwithstanding, both GPs and nurses scored statistically significantly higher than HCAs for intention to *inform* their patients; and nurses scored statistically significantly higher than HCAs for intention to *suggest* that patients go for a dental check-up. Whilst there were no SCT predictors for *informing*, self-efficacy was a statistically significant predictor for *suggesting* to go for a check-up. All professional groups agreed that both behaviours differed from usual ways of working, but also agreed on the potential value of the behaviours to their work. Although there was neither agreement nor disagreement to understanding how the behaviours affected their own work, there was a negative response from all professional groups regarding shared organisational understanding about the purpose of *informing* about the links. Regarding legitimation, nurses scored statistically significantly higher than that of GPs for *informing* about the links; and statistically significantly higher than that of GPs and HCAs for *suggesting* to go for a check-up. Nurses were also the top choice of medical HCP to conduct both behaviours and at 'diabetes diagnosis' was the optimum timing for the behaviours.

This is the first largescale survey demonstrating that primary care medical clinicians are reporting very little *informing* or indirect referring, indicating a gap in care. It is noted in the literature that there can be a tendency to under-analyse and under-report the qualitative data

from such fields (O'Cathain and Thomas 2004). In this case, the qualitative free text comments further described a lack of knowledge regarding the links between diabetes and periodontitis with some remarks suggesting a defensive reaction relating to professional role in this context. These findings are consistent with previous research (Bissett *et al.* 2013) indicating that HCPs are missing an important opportunity to educate patients with diabetes about the oral complications of their condition and encourage them to access dental treatment with a potential to improve their glycaemic control, which is particularly important if the patient does not already attend a GDP. Notwithstanding, the results also reveal that some HCPs reported that they were positively engaging with their newfound knowledge and intention to incorporate the behaviours into routine diabetes care was evident from both the quantitative and qualitative results. This study demonstrates behavioural and organisational correlates of medical professionals' behaviour that will enable the design of theoretically informed interventions to integrate oral health in the context of diabetes and periodontitis.

4.4.1 Implications based on SCT findings

In comparison to GPs, nurses had higher levels of self-efficacy, intention (SCT, proximal goals) and outcome expectations for *informing*. Perhaps this is because the nurse often plays a pivotal role in patient education and health promotion in diabetes care and feels comfortable in this role (Peimani *et al.* 2010). Regression analyses showed that providing background information prior to completing the questionnaire was associated with *informing* and self-efficacy was a predictor for *suggesting* which indicates that an intervention focusing on self-efficacy may increase the uptake of the behaviour, specifically if the intervention addresses some of the key modifiable barriers from the 12-item list, such as issues surrounding priorities and not being set up for the behaviours. Delivering effective self-care education and motivation to patients takes time and it is recognised that longer appointment times may be necessary (Rees and Williams 2009). As there was little-to-no past behaviour (and a possible lack of knowledge of the context of the behaviours), HCPs will need support to increase self-efficacy. Modelling behaviours, such as the use of vignettes, has been shown to aid conceptualisation of the behaviours and enable evaluation of the elements that may create challenges to performing the behaviours (Bandura 1997).

4.4.2 Implications based on NPT findings

The HCPs clearly agreed that *informing* patients about the links between diabetes and periodontitis and *suggesting* to go for a dental check-up were not part of their normal practice (NPT, differentiation). Despite an absence of past experience and a possible lack of knowledge of the context of the behaviours under question seen by the negative responses to

communal specification, the respondents could see the potential of carrying out both behaviours for their work (NPT, internalisation) and believed that both behaviours were part of their professional role (NPT, legitimation). This 'buy-in' from HCPs, in particular nurses, has not been reported before in the literature and could aid the implementation of new interventions to enhance the oral health component of the diabetes care pathway. Indeed, all three professional groups, including nurses themselves, ranked nurses as being most suited to carry out the behaviours (with GPs being ranked nearer the end of the list of dental and medical HCPs). This, together with the negative response to communal specification, suggests that intervention design should focus on team level understanding, but with an emphasis on individual/nurse level understanding to improve the delivery of the intervention.

4.4.3 Combining insight from SCT and NPT to inform intervention design

Neutral responses were observed across all three professional groups for self-efficacy, outcome expectations and individual-level understanding (NPT, individual specification) for both behaviours. Furthermore, there was a neutral response to shared understanding (NPT, communal specification) for *informing* about the links, whilst for shared understanding regarding *suggesting* to go for a dental check-up, the response was clearly negative. The neutral responses could reflect that the respondents have insufficient knowledge or experience to form strong feelings on their role in emphasising the importance of oral health in patients with diabetes. Indeed, the randomisation of the presence of background information was strongly associated with (self-reported) past behaviour *informing* about the links, which indicates the importance of including an explanation of the relationship between diabetes and periodontitis and the implications for best practice in intervention design. It is also possible that by giving background information to some of the respondents, that this may have influenced their reported past behaviour of *informing*, as they may have perceived that this should have been an important part of their role.

SCT and NPT have previously been used effectively in health promotion in the context of chronic disease management, but this is the first time they have been combined, and is a unique feature to this study (Bandura 2004, Kennedy *et al.* 2013, May *et al.* 2018). The theories are very different. SCT is a behaviour change theory stemming from psychology and is well-established in the literature for its predictive utility and for its ability to propose strategies for changing behaviour and explain behaviour change. NPT is more contemporary, having been built from empirical studies looking at the implementation process, specifically exploring what 'work' needs to be done to implement a change. NPT items, in particular sense-making (coherence) and legitimation (cognitive participation), were selected following

previous research (Bissett *et al.* 2013) which suggested a lack of knowledge and legitimation which, in some way, explained a lack of behaviour on the part of HCPs in the context of diabetes and periodontitis. These items were particularly relevant when at the 'front end' of intervention design and the implementation process (Finch 2008). As the evaluation process progresses, other items should be considered. Interventions should include information on the links between diabetes and periodontitis to improve knowledge before the HCPs can begin to build up their self-efficacy.

Studies have shown that information to effect self-care management in patients with chronic diseases such as diabetes, should be given at diagnosis, and, from then onwards, should be repeated for patients to establish the connection (Rees and Williams 2009). The respondents ranked 'at the time of diabetes diagnosis' as the best time for both informing patients about the links and suggesting that they go for a check-up; and in the event of the patient having already received their diagnosis, they should be informed at their next annual review.

4.4.4 Strengths and weaknesses

This is the first large scale survey demonstrating clearly through the use of key implementation theories that primary care medical clinicians are reporting very little informing or verbal referring, indicating a clear gap in care. The use of both theories gave added value in identifying SCT elements which could predict the behaviours, and exploring elements of NPT which will be used to improve the implementation process. The result was a detailed identification of behavioural and organisational components which will improve intervention design and aid effective evaluation, feeding back into the development of appropriate interventions.

Responses based on self-report are intrinsically biased, however, the very low levels of behaviour reported indicate that there is a gap in care and this finding can provide the foundation for future implementation science research.

SCT correlates were small and the standardised regression coefficients were also small, perhaps due to the low levels of past behaviour reported (dependent variable). Whilst there was a large effect size for background information being associated with *informing* and self-efficacy was shown to be a predictor for *suggesting*, generally the SCT regression model should be interpreted with caution as past behaviour was used as a proxy for future behaviour.

The cross-sectional design precludes any causal inferences being made, and limits ability to say what comes first, behaviour or views about behaviour. However, this was the first study to

explore these behaviours. A prospective survey design could perhaps provide more understanding of what is necessary to move intention through to action, and future behaviour could then be the dependent variable in regression modelling, which may improve predictability.

4.5 Conclusion

HCPs, particularly nurses, have an important role in *informing* patients with diabetes about the links between diabetes and periodontitis and *suggesting* they go for a dental check-up at diabetes diagnosis or review appointments, particularly for patients who do not attend the GDP. Interventions to enable uptake of these behaviours should aim to raise organisational/communal understanding of the purpose of carrying out these behaviours and individual understanding (in nurses in particular) of how they will affect the nature of their clinical interaction; together with the inclusion of background evidence to raise self-efficacy and support belief systems as to the consequences of the behaviours. The next chapter surveys behavioural and organisational correlates of primary care dental clinician behaviours in the context of best practice diabetes and periodontitis recommendations.

Chapter 5

Chapter 5: Identifying behavioural and organisational correlates of primary care dental professional behaviours in the context of diabetes and periodontitis

5.1 Background

Medical professionals, particularly nurses, would appear to have an important role in informing people with diabetes about the links between diabetes and periodontitis and suggesting they go for a dental check-up (Chapter 4). This is important as there is evidence to suggest that oral health is not a priority for people with diabetes and as a result they tend to have lower dental attendance than the average population (Allen *et al.* 2008, Kelly *et al.* 2000, Tomar and Lester 2000). Recommendations of best dental practice are published in various dental guidance documents (Table 3.1) (Chapple and Genco 2013, Department of Health 2017, European Federation of Periodontology 2012). Each of the documents contain similar recommendations: to inform patients about the links between diabetes and periodontitis and communicate with the GP regarding HbA1c levels and/or in the case of suspecting diabetes. Adoption of these recommendations by dental professionals is essential to ensure that their patients with diabetes are fully informed and receive preventative advice, periodontal monitoring and treatment; but Sandberg et al found that 48% of their participants with diabetes believed that their GDP/DHT were unaware that they had diabetes in their study of oral health and health related quality of life (Sandberg and Wikblad 2003). This would suggest that perhaps there is little communication between the dental professionals and their patient in this context and it is uncertain whether the clinicians consider the bidirectional impact of the two diseases. The aim of this research was to explore current dental practices in relation to periodontal and diabetes care and to ascertain whether best practice recommendations were being adhered to; and if not, why this might be.

5.2 Methods

5.2.1 Study design

The study used a cross-sectional design, involving online questionnaires (Appendix 8) to assess self-reported views on, and performance of, three specific clinical behaviours:

1. *Informing* patients with diabetes about the links between diabetes and periodontitis
2. *Considering* the impact of periodontal treatment on the patient's glycaemic control
3. *Contacting* the patient's GP with regard to their periodontitis and poorly controlled diabetes.

Each behaviour was specified using the 'TACT-A' principle, which is a systematic method recommended by social cognition models of behaviour to specify behaviour for the purpose of predictive studies (Fishbein and Ajzen 2010). In broad terms, the target (T) is patients with diabetes; the action (A) is dental clinician behaviour; the context (C) is primary or secondary dental care; the time (T) is during a clinical interaction; and the actor is the dental clinician. As the questionnaire assessed multiple behaviours, the TCT-A (actor) parts stayed the same whilst the A (action) changed with each of the three behaviours.

5.2.2 Measures

- *Instrument development process*

The questionnaire was developed to assess past behaviour and constructs from SCT (Bandura 1986, Bandura 1998, Bandura 2009) and NPT (May and Finch 2009). The questionnaire was piloted by five dental professionals using a 'think aloud' method to identify any ambiguities and to observe ease of navigation. After modification, it was then tested by a further five people to assess the functionality of the e-questionnaire software (Qualtrics 2017), to ensure accessibility via a link within an email, and to ensure that respondents were able to save and continue completion of the questionnaire at a later time prior to submission.

- *Demographic measures*

Participants were asked a series of demographic questions: sex; main job role; year of first registration with the General Dental Council (GDC); year of most recent professional qualification; age; whether they were a registered specialist in periodontics; percentage of time working in primary care/secondary care/community dental services; percentage of time spent in the practise of periodontology; and how many patients with diabetes per month they typically see. Those working in primary care were also asked what percentage of time was spent working under NHS/private fee per item/dental insurance/other contractual arrangements; and percentage of patients who need periodontal treatment that are treated by the GDP/referred to dental hospital/referred to specialist periodontal practice/referred to a DHT.

- *Current behaviour*

Past behaviour was assessed by asking how many of the previous 10 patients with diabetes have the behaviours been carried out on.

- *Social Cognitive Theory*

The questionnaire measured self-efficacy in a 12-item question, by a five point Likert scale (1- strongly disagree, 2- disagree, 3- neither agree nor disagree, 4- agree, 5- strongly agree). Items were informed by previous qualitative exploration of the determinants involved in carrying out behaviours in the context of diabetes and periodontitis (Bissett *et al.* 2013). Outcome expectation was measured using two items, on a five point Likert scale: 'will [the behaviour] be a good use of my time', from '1-not at all', '2-a little', '3-moderately', '4-quite a bit' and '5-extremely' ; and 'will [the behaviour] help my patient', from '1-never', '2-rarely', '3-sometimes', '4-often' and '5-all of the time'. Proximal goals were assessed by asking 'how many of your next 10 patients do you intend to [the behaviour]' and assessed on a 10-point scale.

- *Normalisation Process Theory (NPT)*

Five NPT sub-constructs selected from two of the four core constructs, were measured (Table 4.2): coherence (differentiation, individual specification, communal specification and internalisation) and cognitive participation (legitimation) (Finch *et al.* 2013, May and Finch 2009). The question format was informed by the NPT implementation measure instrument, with the appropriate behaviours inserted, as directed by the authors (May *et al.*); and measured by an eight response Likert scale: '1-strongly disagree' to '5-strongly agree' (as above); and three additional response options which offered '6-not relevant to my role', '7-not relevant at this stage' and '8-not relevant to diabetes care'. The coherence items examined: if the behaviour differed to usual; whether there was shared understanding of the purpose of the behaviour within the organisation; individual understanding of how the behaviour affected the nature of the respondent's work; and whether there was potential value in the behaviour. The last item measured whether the behaviour was a legitimate part of the respondent's job role.

5.2.3 Recruitment and data collection

Participants invited to complete the questionnaire included dental clinical academics, periodontal specialists, GDPs and DHTs working in academia and clinically in primary and secondary care services managing the care of people with diabetes. They were recruited via two professional societies affiliated with periodontology, the BSP and British Society of Dental Hygiene and Therapy (BSDHT). These societies were selected to optimise recruitment, as the members would likely be interested in the subject area. Based on systematic reviews of predictive HCP behaviour regression modelling, a sample size target of n=150 completed questionnaires was set (Godin *et al.* 2008, Rashidian *et al.* 2006). A link to the final questionnaire was emailed to each member of the two societies (combined

membership of 4,000: BSP 1,000 and BSDHT 3,000). The recruitment period ran from January to May 2016. An email invitation with a link to the questionnaire was sent to each member by the society administration team. Respondents were given five weeks to complete and submit the questionnaire, during which time two electronic reminders were sent to non-responders: one at three weeks following the initial invitation; and the other after four weeks, as these have been shown to improve response (Clark *et al.* 2015). Completion and submission of the questionnaire was incentivised via a prize draw to win one of ten, £100 Amazon gift vouchers. The questionnaires were anonymous, however in order to issue prizes, the respondent was invited to provide their GDC registration number should they wish to be entered into the prize draw.

5.2.4 Statistical analyses

IBM SPSS v23 was used to progressively analyse the questionnaire data. Initially, histograms were used to explore distributions and to visually assess normality and skewness. Kolmogorov-Smirnov assessment of normality was carried out and identified that all the data were significantly non-normal, thus non-parametric analyses were used throughout.

For the descriptive analyses, mean and standard deviation, and median and IQR were calculated. Past behaviour, proximal goals and the NPT sub-constructs were single item and distinct from each other. Self-efficacy was a 12 item construct and as internal consistency was high (Cronbach's $\alpha > 0.8$) the multi-item scale was combined to form an overall mean construct score (Cohen 1992, Cronbach 1951). Outcome expectations were assessed in two items and as Spearman's correlation was >0.45, the items could be combined to form an overall mean construct score.

To explore variation in responses according to professional role, the Kruskal Wallis test, a rank-based non-parametric version of the one-way ANOVA, was used to assess whether there were significant differences between the three professional groups (periodontal specialists, GDPs, and DHTs) for past behaviour, the three SCT constructs and the 5 NPT sub-construct items. In those situations where significant differences were found between groups, the Mann Whitney test was used *post-hoc* to compare the differences between pairs of (independent) professional groups in sequence, to identify where the significant differences lay, with a 3-way adjustment for the critical value of p. The critical value of p for determining statistical significance was thus set at 0.05 in general, but at 0.0167 for the *post-hoc* comparisons between professional groups.

SCT correlates of behaviour were first assessed using Spearman's rank bivariate correlation analyses. Further analysis, using binary logistic regression, identified which SCT constructs were predictors for each of the past behaviours. The past behaviour was the dependent variable, being used as a proxy for future behaviour, and was dichotomised for the purpose of the regression ('0 = no behaviour', '1= behaviour'). Three covariates were entered at step one of the regression: job role, specifically whether a specialist or GDP/DHT; registration on the GDC specialist list for periodontics; and the number of patients with diabetes seen per month. The independent variables, the three SCT constructs, were entered at step two of the regression (self-efficacy, outcome expectations and proximal goals), which were initially explored in univariate regression analyses, before being combined within the multivariate logistical regression model consistent with tenets of SCT (Bandura 2009, Godin *et al.* 2008, Rashidian *et al.* 2006).

5.2.5 Qualitative analyses

Two free text qualitative fields were included in the survey at the end of sections one and two, for 'any other comments'. Thematic analysis (Braun and Clarke 2006) was used to identify common attributes within the data as it is used in a broad range of disciplines (Rapley 2011). Notable discussion points and specific comments of interest were noted and codes or key words were applied. Emergent patterns and resultant themes were formulated via an inductive approach to the data analysis. Quotes which illustrated concepts relating to a particular theme were considered in detail and unpacked to explore meaning and develop better understanding. Analytical discussion during research meetings with supervisors provided the opportunity to further explore and clarify the emergent themes.

5.2.6 Regulatory approvals

A favourable opinion from an ethics committee was obtained from North West – Greater Manchester West Research Ethics Committee (REC# 16/NW/0030). R&D approval was granted by Newcastle upon Tyne Hospitals Foundation Trust, who acted as sponsor for the research (R&D# 07394). The project was registered on the NENC and SWP CRN portfolio (Portfolio# 20477).

5.3 Results

- *Response rate and missing data*

346 questionnaires were returned in total: 103 from BSP members (10% response rate); and 243 from BSDHT members (8% response rate). Of those 346 questionnaires, 12 had

missing data on at least one variable, of which eight had >10% of data missing and the other four had missed out a construct completely. Analysis was carried out to compare the 100% completed questionnaires to the <100% completed questionnaires. There were no significant differences between the fully and partially completed questionnaires for gender or age; however with regard to job role, 43% of GDPs and 31% of those who identified themselves as 'other'(a non-clinical job role), submitted partially completed questionnaires which was a significantly higher number (p=0.03) compared to specialists (18%) and DHTs (18%). The partially completed questionnaires comprised 3% of the overall sample and were deleted list-wise. A further six questionnaires belonging to the job role 'other' were removed as the responses of those in a non-clinical role were considered potentially hypothetical and therefore not representative. The final sample was therefore n=328: comprising 42 periodontal specialists, 13 GDPs, and 273 DHTs.

- *Sample characteristics*

Table 5.1 shows the sample sociodemographic and clinical practice descriptive statistics. 274 (84.3%) of the sample were females; with 238 (72.6%) of the sample from BSDHT; and 183 (55.8%) were within the 40-60 age bracket, with the remainder generally younger. DHTs saw twice the number of patients with diabetes per month (21.29 ± 23.74 patients), compared to specialists (10.16 ± 9.83 patients). While GDPs reported spending the least amount of time on the practise of periodontology, however this was still a large percentage of their time (43.08 ± 25.29%). A small amount of periodontology was reported to be provided under NHS contracts (15.84 ± 29.01%), with the majority being treated privately or by some other non-NHS payment scheme. GDPs who were BSP members treated a large percentage of patients with periodontitis themselves (69.65 ± 34.89%), and if they referred, it was mostly to DHTs in their practice (24.99 ± 33.07%), with a very small portion of patients being referred elsewhere (5.35 ± 14.33%). DHTs' experience of referral was that a large percentage of periodontal treatment was referred to them (78.75 ± 23.81%), rather than being treated by the GDPs in their practices (11.29 ± 18.98%). Small numbers were referred to dental hospitals (3.15 ± 4.74%) or specialist practices (6.81 ± 12.51%).

Table 5.1 Sample characteristics: descriptive statistics of dental survey data (n=328)

Sociodemographic and clinical (n=328)		**n (%)**
Sex	Female	274 (84.3)
Age (years)	<30	41 (12.5)
	30-40	85 (25.9)
	40-50	89 (27.1)
	50-60	94 (28.7)
	>60	19 (5.8)
Sample recruitment	BSP	90 (27.4)
	BSDHT	238 (72.6)
		Mean ± SD
Years since first registered with GDC		19.78 ± 11.82
Years since last (prof) qualification		11.87 ± 10.63
Number of patients with diabetes seen per month	Specialist (n=42)	10.16 ± 9.83
	GDP (n=13)	14.62 ± 12.43
	DHT (n=273)	21.29 ± 23.74
Percentage of clinical time spent in practise of periodontology	Specialist (n=42)	66.83 ± 33.42
	GDP (n=13)	43.08 ± 25.29
	DHT (n=273)	71.12 ± 28.35
Care provision in primary care: percentage of time spent providing periodontal care under	NHS	15.84 ± 29.01
	Private	57.15 ± 33.33
	Denplan	24.29 ± 25.29
	Other	2.71 ± 14.95
Referral practices: BSP experience in primary care – percentage of patients who need periodontal treatment who are:	Treated by GDP	69.65 ± 34.89
	Referred to DHT in the practice	24.99 ± 33.07
	Referred elsewhere	5.35 ± 14.33
Referral practices: BSDHT experience in primary care – percentage of patients who need periodontal treatment who are:	Treated by a GDP	11.29 ± 18.98
	Referred to a dental hospital	3.15 ± 4.74
	Referred to a specialist practice	6.81 ± 12.51
	Referred to DHT in the practice	78.75 ± 23.81

BSP, British Society of Periodontology; BSDHT, British Society of Dental Hygiene and Therapy; GDPs, general dental practitioners; DHTs, dental hygienists and therapists

5.3.1 Descriptive analyses of past behaviour, SCT constructs and NPT items

Dental professionals' self-reported responses for informing patients about the links between diabetes and periodontitis

Table 5.2 shows descriptive statistics for SCT and NPT, together with past behaviour and results of significance testing of the differences between scores depending on the respondent job role, for *informing* patients about the links between diabetes and periodontitis.

- *Self-reported past behaviour*

All dental professional groups reported *informing* most of their patients about the links between diabetes and periodontitis, with mean scores showing high uptake (self-reported past behaviour) as evidenced by more than nine out of the last 10 patients having been informed about the links.

- *Self-efficacy*

When ranking mean self-efficacy scores for each individual self-efficacy item, the barriers that undermined self-efficacy to *inform* patients included 'it is not a priority for me' and 'I am not set up for it', whereas the highest ranked item by all three professional groups was 'work is busy', with clinicians scoring positively that they would remain confident to *inform* patients despite this challenge (Table 5.3). Internal consistency for self-efficacy items was high (Cronbach's $\alpha = 0.94$), suggesting that the 12 items in the scale could be combined to form an overall mean construct score for self-efficacy. As shown in Table 5.2, the specialists' mean self-efficacy score (3.75 ± 1.24) did not differ significantly from GDPs (3.96 ± 0.84), but was significantly higher than DHTs (3.32 ± 1.07).

Table 5.2 Descriptive statistics for *informing* patients about the links between diabetes and periodontitis (n=328)

Theoretical constructs	**Specialists (n=42)** Mean ± SD Median (IQR) Min-Max	**GDPs (n=13)** Mean ± SD Median (IQR) Min-Max	**DHTs (n =273)** Mean ± SD Median (IQR) Min-Max	**p**
Past behaviour	9.83 ± 0.54 10 (10, 10) 8-10	9.31 ± 2.21 10 (10, 10) 2-10	9.34 ± 1.87 10 (10, 10) 0-10	0.60
Self-efficacy (SCT)	3.75 ± 1.24 3.96 (2.33, 3.96) 1-5	3.96 ± 0.84 4 (3.46, 4.83) 2.17-5.00	3.32 ± 1.07 3.33 (2.46, 4.00) 1-5	**0.01 (Sp vs DHTs 0.01)**
Outcome expectations (SCT)	4.54 ± 0.55 4.5 (4, 5) 3-5	4.19 ± 0.60 4.5 (3.75, 4.5) 3-5	4.40 ± 0.65 4.5 (4, 5) 3-5	0.15
Proximal goals (SCT)	9.95 ± 0.31 10 (10, 10) 8-10	10.00 ± 0.00 10 (10, 10) 10-10	9.90 ± 0.62 10 (10, 10) 5-10	0.77
Coherence – differentiation (NPT)	1.87 ± 1.00 2 (1, 2) 1-5	2.62 ± 1.39 3 (1, 4) 1-5	2.44 ± 1.23 2 (2, 3) 1-5	**0.01 (Sp vs DHT 0.01)**
Coherence - communal specification (NPT)	4.10 ± 1.10 4 (4, 5) 1-5	3.62 ± 1.04 4 (3, 4.5) 2-5	3.68 ± 1.13 4 (3, 5) 1-5	**0.02 (Sp vs DHT 0.01)**
Coherence - individual specification (NPT)	4.21 ± 1.06 4 (4, 5) 1-5	4.15 ± 1.07 4 (4, 5) 1-5	3.86 ± 1.05 4 (3, 5) 1-5	**0.02 (Sp vs DHT 0.01)**
Coherence – internalisation (NPT)	4.82 ± 0.39 5 (5, 5) 4-5	4.62 ± 0.51 5 (4, 5) 4-5	4.65 ± 0.52 5 (4, 5) 3-5	0.10
Cognitive participation – legitimation (NPT)	4.90 ± 0.31 5 (5, 5) 4-5	4.85 ± 0.38 5 (5, 5) 4-5	4.74 ± 0.48 5 (5, 5) 3-5	0.07

Note: Past behaviour and proximal goals were 10 point scales; the other measures were five point Likert scales. p = test of differences between professional groups determined using Kruskal-Wallis (with post-hoc Mann Whitney tests and adjustment of critical value of p). GDPs, general dental practitioners; DHTs, dental hygienists and therapists; Sp, specialists; SCT, social cognitive theory; NPT, normalisation process theory. Statistically significant differences are indicated in bold font.

Table 5.3 Self-efficacy items for *informing* patients about the links between diabetes and periodontitis, ranked lowest to highest (n=328)

Self-efficacy items **I am confident that I can *inform* my patients with diabetes about the links between diabetes and periodontitis EVEN WHEN…"**	**All groups (n=328) Mean ± SD**
…it is not a priority for me	2.93 ± 1.60
…I am not set up for it	2.99 ± 1.50
… it is not a priority for the patient	3.05 ± 1.56
…there are problems accessing dental services	3.20 ± 1.31
…it is someone else's responsibility	3.28 ± 1.55
…I am running late	3.35 ± 1.44
…the patient has very few of their own teeth	3.39 ± 1.48
…there is already too much to do	3.49 ± 1.38
…the patient has good dental health	3.56 ± 1.27
…my colleagues are doing the same	3.70 ± 1.22
…my colleagues are not doing the same	3.70 ± 1.26
…work is busy	4.14 ± 1.05

Note: means calculated from five point Likert scale, 1 (strongly disagree) to 5 (strongly agree)

- *Outcome expectations*

Means were higher across all professional groups for *informing* being a 'good use of time', although this was not significantly different from 'helping the patient'. The two outcome expectation questions ('good use of time' and 'helping the patient') were correlated (Spearman's correlation = 0.45), suggesting that the two items could be combined to form an overall mean construct score. There were no significant differences (p=0.15) between professional groups for outcome expectations with similar scores across the groups. The overall response was positive, with means greater than four, medians of 4.5 and a min-max of 3-5 (Table 5.2).

- *Proximal goals*

The responses for proximal goals/intention to *inform* patients about the links were higher when compared to past behaviour, with no significant differences between professional groups (p=0.77). Overall, mean scores of >9.9 were identified, with all professional groups giving very similar scores.

- *Coherence: differentiation*

The first NPT item (Table 5.2) states that '*informing* patients about the links between diabetes and periodontitis differs from usual ways of working'. The majority of responses were negative, dental professionals disagreeing that *informing* patients differed from usual practice. However, there was variance within each professional group across the entire Likert scale. The response from specialists (1.87 ± 1.00) was significantly lower than that of DHTs (2.44 ± 1.23) (p=0.01), indicating that specialists more strongly disagreed (compared to DHTs) that *informing* patients about the links between diabetes and periodontitis differs from usual ways of working. GDPs gave the highest response to this item (2.62 ± 1.39) indicating that they disagreed less strongly then the specialists that *informing* patients differed from usual ways of working, though this failed to achieve statistical significance (possibly due to the low n value of GDPs).

- *Coherence: communal specification*

The second NPT item states that 'staff in the organisation share understanding of the purpose of *informing* patients about the links'. There was strong agreement that understanding about the purpose of the behaviour was shared, but there was also variation seen across all professional groups. A large difference was seen between specialists (4.10 ± 1.10) and GDP/DHTs which was statistically significant when comparing specialists and DHTs (3.68 ± 1.13) (p=0.01), but not when comparing specialists and GDPs (3.62 ± 1.04) (p>0.0167).

- *Coherence: individual specification*

The next coherence item was a statement about understanding on an individual level: 'I understand how *informing* about the links affects the nature of my own work'. The responses were highly positive; but variation was observed across the entire Likert scale, with DHTs (3.86 ± 1.05) scoring the least positive for this item, which was significantly different from specialists (4.21 ± 1.06) (p=0.01).

- *Coherence: internalisation and cognitive participation - legitimation*

Responses to seeing the potential value and legitimation of *informing* patients about the links between diabetes and periodontitis, were highly positive with medians of 5 across all professional groups, with no significant differences detected and compared to the first three NPT items, very little variation between the professional groups (Table 5.2).

Dental professionals' self-reported responses for considering the impact of periodontal treatment on glycaemic control

Table 5.4 shows descriptive statistics for SCT and NPT, together with past behaviour and results of significance testing between scores depending on the respondent job role, for *considering* the impact of periodontal treatment on glycaemic control.

- *Self-reported past behaviour*

All dental professional groups reported high uptake (self-reported past behaviour) *of considering* the impact of periodontal treatment on diabetes control, with mean scores showing that the clinicians considered this element of care for more than eight out of their last 10 patients.

- *Self-efficacy*

Similarly to the results for *'informing'*, when ranking mean self-efficacy scores for each individual self-efficacy item, the barriers that undermined self-efficacy to *consider* the impact of treatment most included 'it is not a priority for me' and 'I am not set up for it'. The highest ranked item by all three professional groups was 'work is busy', with clinicians scoring positively that they would remain confident to *consider* the impact of treatment despite this challenge (Table 5.5). Internal consistency for self-efficacy items was high (Cronbach's α = 0.96), suggesting that the 12 items in the scale could be combined to form an overall mean construct score for self-efficacy. As shown in Table 5.4, specialists' mean self-efficacy score (3.88 ± 1.18) did not differ from that of GDPs (4.07 ± 0.69), or DHTs (3.57 ± 1.03).

- *Outcome expectations*

Means were higher across all professional groups for considering being a 'good use of time', although this was not significantly different to 'helping the patient'. The two outcome expectation questions ('good use of time' and 'helping the patient') were correlated (Spearman's correlation = 0.46), suggesting that the two items could be combined to form an overall mean construct score. There was no significant difference between professional groups for outcome expectations and little variance was seen. The overall response was positive with means greater than four and medians of 4.5 (Table 5.4).

- *Proximal goals*

The responses for proximal goals/intention to consider the impact of treatment were higher when compared to past behaviour, with no significant differences between groups. Overall, mean scores were high across all groups (with means >9.62); however, there was still some variation between the DHTs and specialists responses across the full range of responses for both these groups (Table 5.4).

- *Coherence: differentiation*

The first NPT item asks whether the behaviour is different to usual ways of working. As expected, the majority of scores were low, with dental professionals disagreeing that considering the impact differed from usual practice. However, there was variation within each professional group across the entire Likert scale. The response from specialists (2.23 ± 1.20) was significantly lower than that of DHTs (2.93 ± 1.25) ($p<0.001$) indicating that specialists disagreed more strongly that considering the impact differed from usual practice. GDPs gave intermediate responses between specialists and DHTs, and the median score for both GDPs and DHTs was 3, indicating neither agree nor disagree (Table 5.4).

Table 5.4 Descriptive statistics for *considering* the impact of periodontal treatment on glycaemic control and periodontitis (n=328)

Theoretical constructs	**Specialists (n=42)** Mean ± SD Median (IQR) Min-Max	**GDPs (n=13)** Mean ± SD Median (IQR) Min-Max	**DHTs (n =273)** Mean ± SD Median (IQR) Min-Max	**p**
Past behaviour	8.56 ± 2.80 10 (7.5, 10) 0-10	8.46 ± 2.82 10 (8, 10) 1-10	8.21 ± 2.93 10 (7, 10) 0-10	0.55
Self-efficacy (SCT)	3.88 ± 1.18 4.08 (2.98, 5.00) 1-5	4.07 ± 0.69 4 (3.5, 4.83) 2.83-5.00	3.57 ± 1.03 3.75 (2.79, 4.29) 1-5	0.04
Outcome expectations (SCT)	4.32 ± 0.79 4.5 (4, 5) 3-5	4.42 ± 0.45 4.5 (4.00, 4.75) 3.5-5	4.33 ± 0.72 4.5 (4, 5) 2-5	0.99
Proximal goals (SCT)	9.66 ± 1.49 10 (10, 10) 1-10	9.62 ± 1.39 10 (10, 10) 5-10	9.71 ± 1.42 10 (10, 10) 0-10	0.86
Coherence – differentiation (NPT)	2.23 ± 1.20 2 (1, 3) 1-5	2.54 ± 1.20 3 (1, 3.5) 1-4	2.93 ± 1.25 3 (2, 4) 1-5	**<0.001 (SP vs DHT <0.001)**
Coherence - communal specification (NPT)	3.82 ± 1.14 4 (3, 5) 1-5	3.23 ± 1.17 3 (2, 4.5) 2-5	3.65 ± 1.12 4 (3, 5) 1-5	0.13
Coherence - individual specification (NPT)	4.21 ± 0.98 4 (4, 5) 1-5	4.15 ± 0.80 4 (4, 5) 2-5	3.94 ± 1.04 4 (3, 5) 1-5	0.22
Coherence – internalisation (NPT)	4.46 ± 0.85 5 (4, 5) 1-5	4.62 ± 0.51 5 (4, 5) 4-5	4.47 ± 0.64 5 (4, 5) 1-5	0.72
Cognitive participation – legitimation (NPT)	4.54 ± 0.82 5 (4, 5) 1-5	4.77 ± 0.44 5 (4.5, 5) 4-5	4.61 ± 0.59 5 (4, 5) 1-5	0.67

Note: Past behaviour and proximal goals were 10 point scales; the other measures were 5 point Likert scales. *p* = test of differences *between* professional groups determined using Kruskal-Wallis (with post-hoc Mann Whitney tests and adjustment of critical value of p). GDPs, general dental practitioners; DHTs, dental hygienists and therapists; Sp, specialists; SCT, social cognitive theory; NPT, normalisation process theory. Statistically significant differences are indicated in bold font.

Table 5.5 Self-efficacy items for *considering* the impact of periodontal treatment on glycaemic control, ranked lowest to highest (n=328)

Self-efficacy items **I am confident that I can *consider* the impact of periodontal treatment on their diabetic control EVEN WHEN…**	**All groups (n=328) Mean ± SD**
…it is not a priority for me	3.26 ± 1.48
…I am not set up for it	3.37 ± 1.36
… it is not a priority for the patient	3.39 ± 1.42
…there are problems accessing dental services	3.47 ± 1.25
…it is someone else's responsibility	3.60 ± 1.37
…I am running late	3.61 ± 1.32
…the patient has very few of their own teeth	3.67 ± 1.32
…there is already too much to do	3.71 ± 1.26
…my colleagues are not doing the same	3.77 ± 1.14
…the patient has good dental health	3.79 ± 1.15
…my colleagues are doing the same	3.81 ± 1.11
…work is busy	4.19 ± 0.98

Note: means calculated from five point Likert scale, 1 (strongly disagree) to 5 (strongly agree)

- *Coherence: communal specification*

The second NPT item asks about shared understanding of staff in the organisation. There was a positive response to understanding about the purpose of *considering* being shared with medians of 4 from the specialists/DHTs and 3 from the GDPs, but there was also variation seen across all professional groups, with no significant differences between groups being identified (p=0.13).

- *Coherence: individual specification*

The next coherence item asks whether it is understood how the behaviour affects the nature of their work. The responses were highly positive with medians of 4, although there was still a variation was seen across the entire Likert scale for all professional groups, and no significant differences between groups (p=0.22).

- *Coherence: internalisation and Cognitive participation - legitimation*

Responses to seeing the potential value and legitimation of *considering* the impact of periodontal treatment on glycaemic control were highly positive with medians of 5 in all professional groups, with no significant differences detected (p=0.67); but there was variation particularly in the specialist and DHT groups with a full range of Likert responses being reported.

Dental professionals' self-reported responses for <u>contacting</u> the GP with regard to periodontitis and poorly controlled diabetes

Table 5.6 shows descriptive statistics for SCT and NPT, together with past behaviour and results of significance testing between scores depending on the respondent job role, for *contacting* the patient's GP with regard to periodontitis and poorly controlled diabetes.

- *Self-reported past behaviour*

All dental professional groups reported low uptake of *contacting* their patient's GP, with a score of 3.33 ± 4.16 for the specialists, which was (non-significantly) higher than that of GDPs (0.75 ± 1.06), and significantly higher than that of DHT's (0.57 ± 1.37) (p<0.001).

- *Self-efficacy*

The mean scores for all 12 self-efficacy items were very similar, but when ranked the barriers that least undermined self-efficacy to *contact* the GP were 'it is not a priority for me' and 'it is not a priority for the patient'. The highest ranked item by all 3 professional groups was 'my colleagues are not doing the same', with respondents scoring positively that they would

remain confident to *contact* the patient's GP despite this challenge (Table 5.7). Internal consistency for self-efficacy items was high (Cronbach's $\alpha = 0.96$), suggesting the 12 items in the scale could be combined to form an overall mean construct score for self-efficacy. Mean self-efficacy scores of the specialists (3.65 ± 1.16) did not differ significantly from those of GDPs (3.01 ± 0.75), but they were significantly higher than those of DHTs (2.83 ± 0.89) ($p<0.001$).

- *Outcome expectations*

Means were the same for *contacting* being a 'good use of time' and 'helping the patient'. The two outcome expectation questions ('good use of time' and 'helping the patient') were correlated (Spearman's correlation = 0.68), suggesting that the two items could be combined to form an overall mean construct score. GDP and DHTs scored similarly for outcome expectations with means of just over 3 and median (IQR) of 3.5 (2.25, 4.00). Specialists scored higher for outcome expectations (3.73 ± 0.99), though this was not significantly different from the other two groups (median 4, IQR 3, 4.5) ($p=0.44$).

- *Proximal goals*

The responses for proximal goals/intention to *contact* the patient's GP were higher when compared to past behaviour across all professional groups, with respondents scoring a mean of >4.49. However, variance was high (SDs ≥ 3.91) and there was variation seen across all professional groups, with a full range of responses (0-10), and no significant differences between groups ($p=0.14$).

- *Coherence: differentiation*

The histogram shows that the majority of responses were positive, dental professionals agreeing that *contacting* the patient's GP was not usual practice. However, there was variation between the responses from each professional group. The mean and median for the specialists were close to the mid-Likert point at 2.97 and 3 respectively. This was significantly different ($p<0.001$) to DHTs, indicating that DHTs agreed more strongly than specialists that *contacting* the patients GP differs from usual ways of working.

Table 5.6 Descriptive statistics for *contacting* the patient's GP with regard to periodontitis and poorly controlled diabetes (n=328)

Theoretical constructs	**Specialists (n=42)** Mean ± SD Median (IQR) Min-Max	**GDPs (n=13)** Mean ± SD Median (IQR) Min-Max	**DHTs (n =273)** Mean ± SD Median (IQR) Min-Max	**p**
Past behaviour	3.44 ± 4.16 1 (0, 7.75) 0-10	0.75 ± 1.06 0 (0, 1.75) 0-3	0.57± 1.37 0 (0, 0) 0-10	**<0.001 (Sp vs DHT <0.001)**
Self-efficacy (SCT)	3.65 ± 1.16 3.75 (2.90, 4.94) 1-5	3.01 ± 0.75 2.92 (2.46, 3.92) 1.75-4	2.83 ± 0.89 2.91 (2.17, 3.33) 1-5	**<0.001 (Sp vs DHT <0.001)**
Outcome expectations (SCT)	3.73 ± 0.99 4 (3, 4.5) 2-5	3.19 ± 1.11 3.5 (2.25, 4.00) 1-4.5	3.28 ± 0.99 3.5 (2.5, 4.00) 1-5	0.44
Proximal goals (SCT)	5.46 ± 4.30 5 (2, 10) 0-10	5.85 ± 3.91 5 (2.5, 10) 0-10	4.49 ± 4.28 4 (0, 10) 0-10	0.14
Coherence – differentiation (NPT)	2.97 ± 1.25 3 (2, 4) 1-5	3.46 ± 0.97 3 (3, 4) 2-5	4.00 ± 0.99 4 (4, 5) 1-5	**<0.001 (Sp vs DHT <0.001)**
Coherence - communal specification (NPT)	3.46 ± 0.94 3 (3, 4) 2-5	2.69 ± 1.03 3 (2, 3.5) 1-4	3.01 ± 1.16 3 (2, 4) 1-5	**0.01 (Sp vs DHT 0.01)**
Coherence - individual specification (NPT)	3.97 ± 0.84 4 (3.5, 5) 2-5	3.69 ± 0.86 4 (3, 4) 2-5	3.64 ± 0.86 4 (3, 4) 1-5	**0.05 (Sp vs DHT 0.01)**
Coherence – internalisation (NPT)	4.08 ± 0.96 4 (4, 5) 2-5	4.08 ± 0.64 4 (4, 4.5) 3-5	3.88 ± 0.87 4 (3, 4) 1-5	0.25
Cognitive participation – legitimation (NPT)	4.03 ± 0.87 4 (3, 5) 2-5	3.77 ± 0.73 4 (3, 4) 3-5	3.61 ± 0.96 4 (3, 4) 1-5	**0.03 (Sp vs DHT 0.01)**

Note: Past behaviour and proximal goals were 10 point scales; the other measures were 5 point Likert scales. p = test of differences between professional groups determined using Kruskal-Wallis (with post-hoc Mann Whitney tests and adjustment of critical value of p). GDPs, general dental practitioners; DHTs, dental hygienists and therapists; Sp, specialists; SCT, social cognitive theory; NPT, normalisation process theory. Statistically significant differences are indicated in bold font.

Table 5.7 Self-efficacy items for *contacting* the patient's GP with regard to periodontitis and poorly controlled diabetes, ranked lowest to highest (n=328)

Self-efficacy items **I am confident that I can *contact* my patient's GP with regard to their periodontitis and poorly controlled diabetes EVEN WHEN…**	**All groups (n=328) Mean ± SD**
… it is not a priority for the patient	2.83 ± 1.17
…it is not a priority for me	2.87 ± 1.17
…I am running late	2.93 ± 1.21
…there are problems accessing dental services	2.93 ± 1.10
…I am not set up for it	2.94 ± 1.22
…it is someone else's responsibility	2.94 ± 1.17
…work is busy	2.95 ± 1.21
…the patient has good dental health	2.95 ± 1.16
…the patient has very few of their own teeth	2.96 ± 1.20
…there is already too much to do	2.98 ± 1.19
…my colleagues are doing the same	3.06 ± 1.11
…my colleagues are not doing the same	3.10 ± 1.15

Note: means calculated from five point Likert scale, 1 (strongly disagree) to 5 (strongly agree)

- *Coherence: communal specification*

The responses were less skewed for this item, with the majority of responses being clustered around the mid-Likert of neither agree or disagree. Once again, there was a significant difference between the specialists (3.46 ± 0.94) and the DHTs (3.01 ± 1.16) (p=0.01). The responses from GDPs were the most negative, with a mean of 2.69 ± 1.03, very different to the specialists, but failing to achieve statistical significance possibly due to the low number of GDPs who responded. There was also variance seen within each professional group, and a broad range of responses given (Table 5.6).

- *Coherence: individual specification*

The responses were highly positive, with higher mean values compared to those for communal understanding seen across all professional groups. The DHTs and GDPs had almost identical means and medians of 4, with significant differences identified between the DHTs (3.64 ± 0.86) and the specialists (3.97 ± 0.84) (p=0.01). Within each professional group there were variations, specifically the DHT group, giving responses across the entire Likert scale.

- *Coherence: internalisation*

Responses to seeing the potential value of *contacting* the patient's GP about the patient's periodontitis and poorly controlled diabetes were highly positive with medians of 4 across all professional groups and no significant differences were detected between groups (p=0.25). The variance was lower for specialists and GDPs than DHTs, with DHTs giving responses across the entire Likert scale.

- *Cognitive participation: legitimation*

The last NPT item was cognitive participation, legitimation: 'I believe that *contacting* the patient's GP about their periodontitis and poorly controlled diabetes is a legitimate part of my role'. There was a significant difference between specialists (4.03 ± 0.87) and DHTs (3.61 ± 0.96) (p=0.01); but not between GDPs (3.77 ± 0.73) and specialists. Similarly to the previous item, the variance was lower for specialists and GDPs than it was for DHTs, who gave responses across the entire Likert scale.

Summary of descriptive analysis for SCT and NPT for all three behaviours

Based on self-reported clinician responses, the majority of respondents reported *informing* patients about the links between diabetes and periodontitis and *considering* the impact of periodontal treatment on glycaemic control, for most of their patients with diabetes and

periodontitis. These scores were consistent with high scores for proximal goals, outcome expectations, internalisation and legitimation. There were, however, significant differences seen between the responses of the specialists and DHTs for self-efficacy, differentiation and specification, both individual and communal. It is likely that, had the n value of GDPs been higher, similar differences between specialists and GDPs would have been observed, given that GDPs often gave numerically similar responses to DHTs.

The responses for *contacting* the patient's GP with regard to periodontitis and poorly controlled diabetes were low for most items, with significant differences between scores from the specialists and DHTs. These results were consistent with proximal goals, which were low, and outcome expectations were just over the mid-Likert point. Mean scores for self-efficacy were similar for specialists and GDPs, but significantly different between specialists and DHTs, which was also reflected in the responses to NPT items, apart from internalisation.

5.3.2 Correlates of past behaviour and SCT constructs

SCT correlates for informing patients about the links between diabetes and periodontitis

Table 5.8 shows Spearman SCT correlations for past behaviour, *informing* patients about the links between diabetes and periodontitis. The correlations were positive and statistically significant. The strongest correlation was between proximal goals and past behaviour (0.39); followed by a moderate correlation of past behaviour with outcome expectations (0.25); and a weak correlation between self-efficacy and past behaviour (0.14).

Table 5.8 SCT correlates for *informing* patients about the links between diabetes and periodontitis (n=328)

	Past behaviour	Self-efficacy	Outcome expectations	Proximal goals
Past behaviour	-			
Self-efficacy	0.14*	-		
Outcome expectations	0.25**	0.10	-	
Proximal Goals	0.39**	0.08	0.15**	-

Spearman's correlations between Social Cognitive Theory (SCT) correlates. **p<0.01; *p<0.05

SCT correlates for considering the impact of periodontal treatment on glycaemic control

Table 5.9 shows Spearman's SCT correlations for past behaviour, *considering* the impact of periodontal treatment on glycaemic control. The correlations were positive, statistically significant and moderate between past behaviour and self-efficacy (0.28), outcome expectation (0.23) and proximal goals (0.23).

Table 5.9 SCT correlates for *considering* the impact of periodontal treatment on glycaemic control (n=328)

	Past behaviour	Self-efficacy	Outcome expectations	Proximal goals
Past behaviour	-			
Self-efficacy	0.28**	-		
Outcome expectations	0.23**	0.22**	-	
Proximal Goals	0.23**	0.16**	0.13*	-

Spearman's correlations between Social Cognitive Theory (SCT) correlates. **p<0.01; *p<0.05

SCT correlates for contacting the patient's GP with regard to periodontitis and poorly controlled diabetes

Table 5.10 shows Spearman's SCT correlations for past behaviour, *contacting* the patient's GP with regard to periodontitis and poorly controlled diabetes. The correlations were positive, statistically significant and moderate between past behaviour and self-efficacy (0.21), outcome expectation (0.34) and proximal goals (0.37).

Table 5.10 SCT correlates for *contacting* the patient's GP with regard to periodontitis and poorly controlled diabetes (n=328)

	Past behaviour	Self-efficacy	Outcome expectations	Proximal goals
Past behaviour	-			
Self-efficacy	0.21**	-		
Outcome expectations	0.34**	0.25**	-	
Proximal Goals	0.37**	0.17**	0.40**	-

Spearman's correlations between Social Cognitive Theory (SCT) correlates. **p<0.01; *p<0.05

Summary of the SCT correlates for all three behaviours

The correlations were positive, statistically significant and the majority were moderate for the three behaviours, apart from self-efficacy for *informing* which was weak. The constructs were not strongly correlated with each other.

5.3.3 Binary logistic regression analysis of past behaviour and SCT constructs

A hierarchical logistic regression was conducted to assess which SCT constructs predict the dental clinicians' past behaviour in relation to diabetes and periodontal management. Past behaviour was used as a proxy for future behaviour, due to the questionnaire being cross-sectional in design, and was the dependent variable. At step one, the covariates of job role, registered on specialist list and number of patients with diabetes seen per month were entered into the model. At step two, the SCT constructs were entered initially in a univariate model (i.e. each in a separate analysis), followed by multivariate analysis which combined SCT constructs in the same model.

- Modelling SCT constructs as correlates of informing patients about the links between diabetes and periodontitis

The covariates of job role ($\beta = 0.34$, $p = 0.60$) and the number of patients with diabetes seen per month ($\beta = 0.00$, $p = 0.89$) had small regression coefficients and were not statistically significant and therefore they did not appear to be associated with the behaviour. Being on the specialist list ($\beta = 0.81$, $p = 0.50$), although not significant, had a large regression coefficient however, the large standard error (SE = 1.21) and wide confidence interval (95% CI 0.21 – 24.29) indicate large variation possibly due to the fact that only 21 out of the sample population were on the specialist list, compared to 307 who were not.

- SCT constructs as predictors of past behaviour informing about the links between diabetes and periodontitis

Table 5.11 shows the multivariate logistic regression model for *informing* patients with diabetes about the links between diabetes and periodontitis. The predictors for *informing* accounted for a medium amount of variance (Cox & Snell R^2 0.14; and Nagelkerke R^2 0.24), with outcome expectations ($\beta = 0.89$, $p<0.001$) and proximal goals ($\beta = 1.61$, $p<0.001$) as significant predictors (Cohen 1992). Self-efficacy was not statistically significant ($\beta = 0.28$, $p = 0.13$) when it was included in a model that controlled for demographic factors and included other SCT constructs.

Table 5.11 Multivariate logistic regression model predicting past *informing* patients with diabetes about the links between diabetes and periodontitis (n=328)

Predictors	*β*	*B*	*SE*	*p*	*95% CI B* Coefficient	
					Lower	Upper
Job role	0.34	1.41	0.66	0.60	0.39	5.11
Registered on specialist list	0.81	2.26	1.21	0.50	0.21	24.29
Number of patients with diabetes seen per month	0.00	1.00	0.02	0.89	0.97	1.03
Self-efficacy	0.28	1.32	0.18	0.13	0.93	1.87
Outcome Expectation	0.89	2.44	0.27	**<0.001**	1.45	4.11
Proximal Goals	1.61	5.01	0.56	**<0.001**	1.66	15.13

Cox & Snell R^2 0.14, Nagelkerke R^2 0.24
R^2 variance; *β* standardised regression coefficient; *B* exponential of B (odds ratio); *SE* standard error; *p* test of difference (statistically significant differences are indicated in bold font); CI confidence interval.

- *Modelling SCT constructs as correlates of considering the impact of periodontal treatment on glycaemic control*

Table 5.12 shows the multivariate logistic regression model for *considering* the impact of periodontal treatment on glycaemic control. None of the covariates were statistically significant, however, job role had a high negative regression coefficient (β = -0.89, p = 0.13), as did registered on specialist list (β = -0.56, p = 0.49). The number of patients with diabetes seen per month had a very low regression coefficient (β = 0.01, p=0.20) and therefore does not appear to be associated with the behaviour. The predictors for *considering* the impact of treatment accounted a medium amount of variance (Cox & Snell R^2 0.11; and Nagelkerke R^2 0.15), with all three SCT constructs as statistically significant predictors. Outcome expectations (β = 0.58, p<0.001) was the strongest predictor, followed by self-efficacy (β = 0.36, p = 0.01) and then proximal goals (β = 0.23, p<0.05).

Table 5.12 Multivariate logistic regression model predicting past *considering* the impact of periodontal treatment on glycaemic control (n=328)

Predictors	*β*	*B*	*SE*	*p*	*95%* CI *B* Coefficient	
					Lower	Upper
Job role	-0.89	0.41	0.58	0.13	0.13	1.29
Registered on specialist list	-0.56	0.57	0.81	0.49	0.12	2.80
Number of patients with diabetes seen per month	0.01	1.01	0.01	0.20	0.99	1.03
Self-efficacy	0.36	1.44	0.13	**0.01**	1.12	1.84
Outcome Expectation	0.58	1.79	0.18	**<0.001**	1.26	2.55
Proximal Goals	0.23	1.26	0.11	**<0.05**	1.01	1.57

Cox & Snell R^2 0.11, Nagelkerke R^2 0.15
R^2 variance; *β* standardised regression coefficient; *B* exponential of *β* (odds ratio); SE standard error; p test of difference (statistically significant differences are indicated in bold font); CI confidence interval.

- *Modelling SCT constructs as correlates of <u>contacting</u> the patient's GP with regard to periodontitis and poorly controlled diabetes*

Table 5.13 shows the multivariate logistic regression model for *contacting* the patient's GP with regard to periodontitis and poorly controlled diabetes. None of the covariates were significant when included in a model that controlled for demographic factors and included all the SCT constructs, however, being on the specialist list had high standardised regression coefficient (β = 1.25), but large standard error (SE = 0.86) and a wide confidence interval (95% CI = 0.65 – 18.68), indicating a strong relationship, but wide variations in responses. The predictors for *contacting* the patient's GP accounted for a medium amount of variance (Cox & Snell R^2 0.20; and Nagelkerke R^2 0.29), with both outcome expectations (β = 0.54, p<0.001) and proximal goals (β = 0.13, p<0.001) as statistically significant predictors (Cohen, 1992). Self-efficacy was not statistically significant when it was included in a model that controls for demographic factors and includes other SCT constructs.

Table 5.13 Multivariate logistic regression model predicting past *contacting* the patient's GP with regard to periodontitis and poorly controlled diabetes (n=328)

Predictors	*β*	*B*	*SE*	*p*	*95%* CI *B* Coefficient	
					Lower	Upper
Job role	-0.44	0.64	0.60	0.46	0.20	2.08
Registered on specialist list	1.25	3.49	0.86	0.14	0.65	18.68
Number of patients with diabetes seen per month	0.01	1.01	0.01	0.43	0.99	1.03
Self-efficacy	0.22	1.25	0.17	0.21	0.89	1.75
Outcome Expectation	0.54	1.72	0.18	**<0.001**	1.21	2.44
Proximal Goals	0.13	1.14	0.04	**<0.001**	1.06	1.24

Cox & Snell R^2 0.20, Nagelkerke R^2 0.29
R^2 variance; *β* standardised regression coefficient; *B* exponential of *β* (odds ratio); SE standard error; p test of difference (statistically significant differences are indicated in bold font); CI confidence interval.

Summary of results using SCT to identify modifiable correlates of dental professionals' reported behaviours

The regression modelling for all three behaviours accounted for medium variance in self-reported responses. All three independent SCT constructs (self-efficacy, outcome expectations and proximal goals) significantly predicted *considering* the impact of periodontal treatment on glycaemic control; whilst for *informing* and *contacting* the patient's GP with regard to periodontitis and poorly controlled diabetes, outcome expectations and proximal goals were significant predictors, and self-efficacy was not.

5.3.4 Who could/who should, carry out the behaviours?

Who could/should inform the patient about the links between diabetes and periodontitis?

The questionnaire asked respondents about who (indicating different categories of clinicians) could/should manage different aspects of inter-disciplinary care of patients with diabetes and

periodontitis. Table 5.14 shows the list of medical and dental HCPs who are involved in the management of patients with diabetes that the respondents were presented with and the frequencies of responses for who could/should *inform* about the links between diabetes and periodontitis. The respondents ranked dental professionals higher than medical professionals to *inform* about the links. Both specialists and DHTs gave statistically significantly higher responses for 'DHT could' compared to 'DHT should', whereas GDPs responded 100% to both 'DHT could' and 'DHT should'. There were no significant differences between professionals for GDPs *informing*, although the difference between the GDPs' responses for 'GDP could/should' would have possibly been significant had the number of GDP respondents been greater. Following dental professionals, and in decreasing order of frequency, the other HCPs who could/should *inform* about the links were GPwSIs, followed by GPs, then DSNs, and then lastly, dieticians.

Who could/should consider the impact of periodontal treatment on glycaemic control?
Table 5.15 shows the list of medical and dental HCPs who are involved in the management of patients with diabetes and the frequencies of responses for who could/should *consider* the impact of periodontal treatment on diabetes control. Overall, the respondents ranked dental professionals higher than medical professionals to *consider* the impact of periodontal treatment on glycaemic control. There were no significant differences between professional groups for *considering*. Following dental professionals, and in decreasing order of frequency, the other HCPs who could/should *consider* the impact of treatment were GPwSI, followed by GPs, then DSNs, and then lastly, dieticians.

Table 5.14 Who could/should *inform* the patient about the links between diabetes and periodontitis?

	Specialists (n=42) N (%)		**p**	**GDPs (n=13)** N (%)		**p**	**DHTs (n =273)** N (%)		**p**
	could	should		could	should		could	should	
No-one	0 (0)	0 (0)	1.00	0 (0)	0 (0)	1.00	2 (0.7)	1 (0.4)	0.56
GP	35 (83.3)	28 (66.7)	**0.01**	13 (100)	12 (92.3)	0.32	242 (88.6)	225 (82.4)	**0.01**
GPwSI	36 (85.7)	31 (73.8)	0.06	13 (100)	13 (100)	1.00	248 (90.8)	232 (85.0)	**0.01**
Dietician	25 (59.5)	18 (42.9)	**0.01**	10 (76.9)	6 (46.2)	0.10	203 (74.4)	158 (57.9)	**<0.001**
Diabetologist	32 (76.2)	30 (71.4)	0.32	12 (92.3)	11 (84.6)	0.32	216 (79.1)	188 (68.9)	**<0.001**
GDP	40 (95.2)	40 (95.2)	1.00	12 (92.3)	13 (100)	0.32	272 (99.6)	267 (97.8)	0.06
DHT	39 (92.9)	32 (76.2)	**0.01**	13 (100)	13 (100)	1.00	269 (98.5)	260 (95.2)	**0.01**
DSN	33 (78.6)	32 (76.2)	0.66	13 (100)	12 (92.3)	0.32	259 (94.9)	233 (85.3)	**<0.001**
Other	4 (9.5)	2 (4.8)	0.16	0 (0)	0 (0)	1.00	27 (9.9)	18 (6.6)	**0.01**

Note: *p* = test of differences between 'could' and 'should' determined using Wilcoxon Signed-Rank test. Statistically significant differences are indicated in bold font. GP, general practitioner; GPwSI, GP with special interest; GDP, general dental practitioner; DHT, dental hygienist and therapist; DSN, diabetes specialist nurse.

Table 5.15 Who could/should *consider* the impact of periodontal treatment on glycaemic control?

	Specialists (n=42) N (%)		**p**	**GDPs (n=13)** N (%)		**p**	**DHTs (n =273)** N (%)		**p**
	could	should		could	should		could	should	
No-one	0 (0)	0 (0)	1.00	0 (0)	0 (0)	1.00	0 (0)	0 (0)	1.00
GP	21 (50.0)	17 (40.5)	0.21	11 (84.6)	9 (69.2)	0.16	165 (60.4)	162 (59.3)	0.69
GPwSI	25 (59.5)	21 (50.0)	0.21	11 (84.6)	11 (84.6)	1.00	193 (70.7)	188 (68.9)	0.51
Dietician	7 (16.7)	7 (16.7)	1.00	7 (53.8)	5 (38.5)	0.16	120 (44.0)	109 (39.9)	0.15
Diabetologist	19 (45.2)	15 (35.7)	0.16	9 (69.2)	7 (53.8)	0.16	157 (57.5)	151 (55.3)	0.39
GDP	39 (92.9)	37 (88.1)	0.32	13 (100.0)	13 (100.0)	1.00	264 (96.7)	267 (97.8)	0.37
DHT	36 (85.7)	32 (76.2)	0.10	13 (100.0)	13 (100.0)	1.00	263 (96.3)	262 (96.0)	0.74
DSN	20 (47.6)	18 (42.9)	0.32	10 (76.9)	9 (69.2)	0.32	182 (66.7)	170 (62.3)	0.11
Other	2 (4.8)	2 (4.8)	1.00	0 (0)	0 (0)	1.00	17 (6.2)	12 (4.4)	0.10

Note: *p* = test of differences between 'could' and 'should' determined using Wilcoxon Signed-Rank test. Statistically significant differences are indicated in bold font. GP, general practitioner; GPwSI, GP with special interest; GDP, general dental practitioner; DHT, dental hygienist and therapist; DSN, diabetes specialist nurse.

Who could/should contact the GP with regard to periodontitis and poorly controlled diabetes?

Table 5.16 shows the list of medical and dental HCPs who are involved in the management of patients with diabetes and the frequencies of responses for who could/should *contact* the GP with regards to periodontitis and poorly controlled diabetes. The respondents ranked dental professionals higher than medical professionals to *contact* the GP. DHT respondents gave statistically significantly higher scores for 'could' than 'should' for *contacting* for GDPs and DHTs, and also DSNs, dieticians and diabetologists. Following dental professionals, and in decreasing order of frequency, the other HCPs who could/should *contact* the patient's GP were DSNs, diabetologists and then lastly, GPwSI.

Table 5.16 Who could/should *contact* the patient's GP with regard to periodontitis and poorly controlled diabetes?

	Specialists (n=42) N (%)		**p**	**GDPs (n=13)** N (%)		**p**	**DHTs (n =273)** N (%)		**p**
	could	should		could	should		could	should	
No-one	2 (4.8)	1 (2.4)	0.32	0 (0)	0 (0)	1.00	0 (0)	1 (0.4)	0.32
GP	0 (0.0)	0 (0.0)	1.00	3 (23.1)	3 (23.1)	1.00	20 (7.3)	24 (8.8)	0.25
GPwSI	9 (21.4)	10 (23.8)	0.56	4 (30.80	4 (30.8)	1.00	43 (15.8)	48 (17.6)	0.28
Dietician	5 (11.9)	3 (7.1)	0.16	2 (15.4)	2 (15.4)	1.00	88 (32.2)	70 (25.6)	**<0.001**
Diabetologist	9 (21.4)	8 (19.0)	0.71	6 (46.2)	5 (38.5)	0.32	101 (37.0)	87 (31.9)	**0.03**
GDP	38 (90.5)	38 (90.5)	1.00	13 (100.0)	13 (100.0)	1.00	269 (98.5)	259 (94.9)	**0.01**
DHT	25 (59.5)	23 (54.8)	0.32	10 (76.9)	7 (53.8)	0.08	224 (82.1)	187 (68.5)	**<0.001**
DSN	12 (28.6)	11 (26.2)	0.66	5 (38.5)	5 (38.5)	1.00	128 (46.9)	97 (35.5)	**<0.001**
Other	3 (7.1)	3 (7.1)	1.00	1 (7.7)	1 (7.7)	1.00	9 (3.3)	12 (4.4)	0.37

Note: *p* = test of differences between 'could' and 'should' determined using Wilcoxon Signed-Rank Test. Statistically significant differences are indicated in bold font. GP, general practitioner; GPwSI, GP with special interest; GDP, general dental practitioner; DHT, dental hygienist and therapist; DSN, diabetes specialist nurse.

Summary of results for who could/should carry out the three behaviours

The respondents ranked dental professionals higher than their medical counterparts across all three behaviours. For *informing,* specialists and DHTs gave statistically significantly higher scores for 'DHT could' than 'DHT should', whilst GDPs responded 100% to both 'DHTs could/should'. There were no significant differences between professional groups for *considering*. DHTs had statistically significantly higher responses for 'could' than 'should' for GDPs and DHTs, but also for DSNs, dietician, and diabetologists.

Following dental professionals, and in decreasing order of frequency, the other HCPs who manage patients with diabetes that were ranked to *inform* about the links and *consider* the impact of treatment were GPwSI, GPs, DSNs and then lastly, dieticians. Following dental professionals, and in decreasing order of frequency, the other HCPs who manage patients with diabetes that were ranked to *contact* the GP were DSNs, diabetologists and GPwSI.

5.3.5 Timing of the behaviours

Table 5.17 presents the frequency statistics for self-reported responses for all respondents for the timing of (i.e. when best to conduct) the behaviours. For both *informing* and *considering,* 83.1% reported 'at time of periodontitis diagnosis' as a good time to carry out the behaviours, followed by 'at time of diabetes diagnosis' (77.7% for *informing* and 59.1% for *considering*). For *contacting* the GP, 65.3% of respondents suggested this behaviour to be carried out 'when the periodontal condition deteriorates' with the next highest score being 'when the patient has poorly controlled diabetes'.

Table 5.17 Frequency statistics for timing options for the behaviours: 'when is it a good time to…' (n=328)

Timing options:	…inform patients about the links between diabetes and periodontitis?	…consider the impact of periodontal treatment on glycaemic control?	…contact the patient's GP with regard to their poorly controlled diabetes?
	N (%)	N (%)	N (%)
Never	6 (1.8)	7 (2.1)	17 (5.0)
At time of periodontal diagnosis	**280 (83.1)**	**280 (83.1)**	142 (42.1)
At time of diabetes diagnosis	262 (77.7)	199 (59.1)	70 (20.8)
At their routine check-up appointment	231 (68.5)	194 (57.6)	53 (15.7)
Alongside discussion regarding their HbA1c	157 (46.6)	131 (38.9)	76 (22.6)
When the patient has poorly controlled diabetes	231 (68.5)	230 (68.2)	200 (59.3)
When the patient is facing being prescribed oral medication (or additional oral medication) for their diabetes	173 (51.3)	169 (50.1)	77 (22.8)
When the patient is facing being put onto insulin or other injectables	172 (51.0)	171 (50.7)	73 (21.7)
At their first appointment in the practice	223 (66.2)	175 (51.9)	51 (15.1)
When the periodontal condition deteriorates	201 (59.6)	205 (60.8)	**220 (65.3)**
Other	15 (4.5)	19 (5.6)	28 (8.3)

Note: highest frequency for each behaviour in bold

5.3.6 Qualitative data from free text fields

Two free text qualitative fields were included in the survey at the end of sections one and two, for 'any other comments'. These were optional fields, so the respondent could leave them blank if they wished. The overall mean response rate was 63.5%, indicating that two thirds of the respondents opted to provide further context, explanation of responses or opinion.

Part one of the survey consisted of questions relating to sociodemographic data (see previous Section 5.2.3): sex; main job role; year of first registration with the GDC; year of most resent professional qualification; age; whether they were a registered specialist in periodontics; percentage of time working in primary care/secondary care/community dental services; percentage of time spent in the practise of periodontology; and how many patients with diabetes per month they typically see. The free text comments in this section generally related to the question which asked for the approximate number of patients with diabetes seen per month as the participant's reported that they found it difficult to answer with accuracy.

The majority of comments related to section two of the survey which consisted of the theory-based measures relating to the three behaviours (*informing* the patient about the links, *considering* the impact of periodontal treatment, and *contacting* the patient's GP) (see Section 5.2.3): current (past) behaviour; SCT self-efficacy; SCT outcome expectations; the five NPT sub-constructs (coherence differentiation, communal and individual specification, and internalisation; and cognitive participation legitimation) and SCT intention (past behaviour). Whilst a few respondents said they were already doing all three behaviours, the majority of comments related to *contacting* the patients GP. There was a general agreement that inter-professional collaboration in the context of diabetes and periodontitis in principle was valued, however the comments indicated there were significant issues surrounding this behaviour. The issues focused on the practicalities of *contacting*: the when, who and how to *contact* the GP. Some respondents used the opportunity for comments to express their frustration with the organisational systems they worked in; and others focused on themselves and their lack of skills or confidence. The qualitative data have been broadly categorised into 'individual responsibility and role' and 'organisational protocol and procedure' themes.

- Individual responsibility and role

All dental professional groups reported low uptake of *contacting* their patient's GP, but specialists reported *contacting* the GP more than GDPs, and significantly more than DHTs. It was unclear whether the respondents had knowledge of best practice recommendations but

many felt that it was the patient's responsibility to relay information relating to their periodontitis to their GP, claiming that it would empower them.

> …Patients should be told about the relationship between periodontitis and diabetes and THEY THEMSELVES should take responsibility for their general health and contact their GP accordingly. (Specialist)

For some respondents, particularly DHTs, the low uptake of *contacting* seemed to trigger a defensive reaction, either suggesting that *contacting* a GP would be operating beyond their role or that it would be working against practice protocol, or that it may even be illegal: "I am not sure of the legality of DHTs *contacting* patient's GP. I would discuss with Practice Principal…" (DHT). A lot of DHTs felt that it was the GDP's job to *contact* the GP, as it was integral to their role to refer patients, for example, they referred the patient to the DHT for treatment and referred the patient to specialist services or for blood tests.

> …As a hygienist working under prescription from GDPs I have never contacted a GP myself, rather I'd consider discussing with GDP and asking them to contact GP. I feel like I'd worry they wouldn't take me seriously as I'm "only a hygienist", plenty of GPs have no idea what we do. I've spoken to a couple of my patients who are diabetic patients and both told me that they have "far more important things to discuss and inform"!! (DHT)

Many respondents feared medical rebuttal like the DHT above or just felt any communication would be ignored: "…I do not usually get much response from GPs...." (GDP). There were descriptions of negative experiences of *contacting* the GP and comments suggesting that the GP would not value the communication. Here a DHT gives their experience of *contacting* the GP, showing inconsistent results.

> …I have contacted 2 GPs in regards to patients with diabetes. One was shocked, but pleased and has been a great help, but the other told me he would only speak to the GDP as I was not qualified enough for him to discuss this with me! (DHT)

In addition to accounts of negative GP responses, there were descriptions of difficult patient encounters in which there was a reluctance to take the information that diabetes and periodontitis were linked seriously because their GP had not told them, so how important could it be? Even the diabetes charities were felt to contribute to the patient's scepticism as they often do not include oral health on the list of things to watch out for.

> …in my experience some patients find it odd and somewhat intrusive when you suggest that you would like to write to their GP about their diabetic condition in a primary care setting. This is not helped by the NHS and diabetes charities who

> underplay or ignore the negative effect of poorly controlled diabetes on their periodontal health. (Specialist)

This idea that the patient wouldn't like the GDP to *contact* their GP or that it could breach confidentiality and special (and time consuming) consent would need to be taken furthermore added to the opinion that *contacting* the GP was a problem. DHTs also acknowledged a lack of confidence: "I do not feel confident in contacting the patient's GP and more often defer the contact to via the GDP."(DHT). In these cases, despite not feeling able to make the *contact* themselves, the DHTs still raised their concerns with the referring GDP.

- *Organisational protocols and procedures*

There is a wide variation in periodontal management between practices. The lack of a standardised protocol for treating patients with diabetes and periodontitis was raised as a significant problem for DHTs, many of whom work between different practices as seen in the following quote.

> …Everywhere I work (3 different practices) seem to have a different view on how patients should be referred for periodontal treatment under the NHS, and the maintenance that they should, or, should not receive…there needs to be some clarification across the board which enforces the correct pathway for NHS periodontitis referrals. Risk factors such as diabetes and other systemic disease get ignored most of the time and should be a trigger factor for regular maintenance, to help reduce the risk of systemic bacterial overload...Unfortunately in my experience corporate companies have made a hygienist service barely profitable … and in some situations costly … forcing GDPs into making less and less referrals…It is a shambolic situation. (DHT)

It was clear that the DHT found the systems that they worked in inconsistent and frustrating. Furthermore they indicated that even the larger corporate practices which, despite having standardised terms of reference, are no better as they deter GDPs from making DHT referrals by charging high referral fees. Some respondents stated that they would bring up the topic of *contacting* the GP in the next practice meeting to initiate debate in order to create a practice protocol. The timing of *contacting* the GP seemed to be very important to some of the respondents who suggested caveats for appropriate *contacting*, such as only if the diabetes is unstable or poor; or the periodontal condition is deteriorating, despite patient compliance with oral hygiene measures; and especially if the patient showed an interest in overall health and wellbeing.

Reference was made by both GDPs and DHTs, to how difficult it was to *contact* a GP. There was not enough time to treat these patients as it was, especially on the NHS if they had severe disease, let alone *contacting* the GP. Dental professionals and medical colleagues are too busy to be phoning or writing letters and it was acknowledged to be very difficult to get to speak with a GP. When the GDP is free to ring, the GP has gone home and emails were referred to as unsafe, as they breach data protection.

> …It would be great to contact GP but in reality it is not practical as both general medical practices and dental practices are too busy. You would also have to obtain consent from the patient. Trying to get through to most GPs is impossible. Most dental clinicians would have to make phone calls after surgery as if you are treating patients every 15 mins you can't stop to make a phone call. By the time you could speak to the GP they have gone home! (DHT)

Some DHT respondents felt they had inadequate undergraduate training that failed to provide the necessary knowledge, skills and competence to discuss the links in detail and *contact* the GP.

> …I do believe that it's important to contact a patient's GP if they have poorly controlled diabetes and are having periodontal treatment, but at the risk of sounding silly, I'm newly qualified and don't know how to get into contact with a patient's GP. It's one of the things that I wish they taught us how to do at university. (DHT)

This lack of training was mentioned by DHTs who were newly qualified and those who had been qualified for some time, suggesting the DHT curriculum needed reviewing, especially if it is to prepare DHTs for when a GDP may not be available or in the case of direct access. Notwithstanding, it appeared that there was an intention to *contact,* even when the DHTs had not done so previously: "I will certainly do this in future. I feel it is necessary. Historically, hygienists were not supposed to *contact* the GP." (DHT).

5.4 Discussion

This phase of the research aimed to investigate behaviours and identify behaviour determinants that may facilitate the uptake by dental clinicians of best practice recommendations in relation to management of periodontitis and diabetes, and has been accepted for publication in the *British Dental Journal* (Bissett *et al.* 2018). The self-reported findings for *informing* about the links and *considering* the impact of periodontal treatment suggest that overall, if a patient with periodontitis and poorly controlled diabetes goes to a dental professional, it is likely that they will be *informed* about the links between the diseases

and their clinician will *consider* the impact of the subsequent periodontal treatment on their glycaemic control.

Respondents scored positively for the NPT item internalisation ('seeing the potential value') for *informing* and *considering*, and identified them as legitimate; which is consistent with the responses for the SCT constructs outcome expectations and intention (proximal goals). However, although responses were relatively high for these behaviours, not everyone shared the same level of SCT self-efficacy and NPT communal specification ('shared understanding of the purpose of the behaviour within the organisation'). The NPT findings also show that not all dental clinicians understand how *informing* 'affects the nature of their work', or 'consider it usual practice'. The significant differences seen between specialist and DHT responses (and perhaps GDPs if the n value would have been greater) indicate that according to self-reports, *informing* is a behaviour that is slightly more likely to be carried out by most specialists, but less so for some DHTs (and GDPs).

The SCT regression analyses suggested that whether clinicians report to *informing* less than 10 of their last 10 patients depends on both their motivation (intention) and their outcome expectations, or beliefs in the consequences of the behaviours. Although self-efficacy was not a significant predictor for *informing*, the fact that there was low confidence in prioritising and being set up for the behaviour suggests that it may still be beneficial to include self-efficacy in an intervention, perhaps to assist with motivation, especially for the DHTs. Whether clinicians reported *considering* for less than 10 of their last 10 patients seemed to depend on all three of the constructs: their outcome expectations, their self-efficacy, and their motivation (intention).

Dental professionals ranked themselves as being the most suited to carry out these behaviours, but every HCP was seen to have potential, although dieticians were given the lowest scores. DHTs 'should' *inform* was statistically significantly lower than 'could' *inform*, according to scores from the specialists and the DHTs themselves. This would suggest that specialists and DHTs perceive the responsibility to *inform* the patient lies with another professional, in this case, the GDP or specialist. GDP's scores were virtually equal for both GDP and DHT 'should/could' indicating that they consider responsibility to *inform* the patient is shared by GDPs and DHTs and considered no more the action of a GDP than a DHT. The time of periodontal diagnosis was ranked as the best time to carry out these behaviours, followed by time of diabetes diagnosis; although all other time options were scored, which would be important if the time of diagnoses had passed.

The quantitative and qualitative findings for *contacting* the patient's GP clearly showed problems with this behaviour which were consistent across all professional groups, with low levels of past behaviour reported. According to self-reports, this behaviour would appear more likely to be carried out by a specialist, than a DHT or GDP; however, specialist's intentions to *contact* the patient's GP in the future remained low, alongside those of DHTs and GDPs.

Intervention modelling for *contacting* the patient's GP should concentrate on outcome expectations and proximal goals, and although not a significant predictor, perhaps self-efficacy would help with motivation; as the self-efficacy items that were most likely to affect confidence were that *contacting* was not considered a priority to the patient or the clinician. NPT responses highlighted the difference between specialists and DHTs in this regard; but confirmed the value placed on the behaviour, suggesting that work on communal specification would increase uptake and could particularly benefit DHTs and GDPs.

All professional groups scored communal understanding lower than individual understanding, suggesting that whilst individuals may understand how *contacting* the patient's GP affects their work, they do not perceive there to be a shared understanding of the purpose of this amongst the staff in their organisation. This may present a barrier to *contacting* the GP from taking place. The qualitative data indicated a need for practice-level discussions on who should, when and how to *contact* the GP. It is unclear whether respondents had knowledge or understanding of the best practice recommendations on this topic, but it was clear that there were significant problems associated with *contacting* the GP. This may explain why the onus for any communication with the GP was placed on the patient by all the professional groups. Notwithstanding, the respondents were in agreement regarding the potential value of *contacting* the patient's GP, despite outcome expectations and proximal goals being low. DHTs responded statistically significantly lower than specialists with regard to differentiation, communal and individual understanding, and legitimation. Furthermore, many DHTs were reluctant to *contact* the GP stating, among other things, that it did not align with their role. It is unclear how this perception had arisen and would require further research to explore, but the GDC clearly indicates in their Scope of Practice document (https://www.gdc-uk.org/professionals/standards/st-scope-of-practice) that DHTs can refer patients to other HCPs. Despite their agreement that this behaviour was different to usual practice, DHTs, similar to both GDPs and specialists, scored positively for the potential for *contacting* to be valued and it being legitimate to their role, indicating potential buy-in if given support, such as training to provide necessary knowledge, skills and confidence.

5.4.1 Strengths and weaknesses

The questionnaire was completed by self-report, which is a quick and direct way of gathering data, however, self-reporting one's behaviour is inherently influenced by recall bias and social desirability bias, which must be taken into account when interpreting the results (Choi and Pak 2005, Sedgwick 2013). The questionnaire consisted predominantly of closed questions, but included a free-text comment field at the end of both sections. It is noted in the literature that there can be a tendency to under-analyse and under-report the qualitative data from such fields (O'Cathain and Thomas 2004). In this case, the free-text fields provided an opportunity for the respondents to contextualise their self-report, which added a rich narrative to the quantitative data, in particularly to the third (and problematic behaviour), *contacting* the patient's GP. The aim of using a questionnaire tool which assessed multiple behaviours enabled the identification of problem behaviours, and the qualitative data will lead to more focused discussion in the subsequent intervention development work.

The aim of recruiting to the questionnaire via the membership of societies affiliated with periodontology was to optimise the response rate; however, the population ratio of professional groups was heavily swayed towards DHTs and somewhat towards specialists. The low response from the GDP group was a weakness that can be appreciated particularly when considering the sub-group analyses. This recruitment strategy meant that the opinions of GDPs who were not specifically interested in periodontology may have been under-represented in this sample.

As the questionnaire was cross-sectional in design, the dependent variable in the logistic regression analysis was self-reported past behaviour, used as a proxy for future behaviour. Longitudinal design using follow-up data would be relevant for future research. The covariate 'being on the specialist list', although not significant in the regression, was associated with past behaviour; however, there was great variability, possibly due to the fact that out of the sample population there were only 21 on the specialist list, compared to 307 who were not.

The second behaviour studied, *considering* the impact of periodontal treatment on glycaemic control, was a cognition rather than a behaviour. Further observational studies would have difficulty in assessing fidelity to this behaviour for this reason. The inclusion of *considering* the impact aimed to identify whether the dental clinicians treated their patient's periodontitis in isolation from their diabetes, which although difficult to validate, was important to consider when developing inter-professional working in the context of diabetes and periodontitis.

This study was unique in combining SCT and NPT in the design of the questionnaire. SCT constructs have been used for decades in the prediction of clinical behaviours and has previously been combined with other theories. NPT is an evolving theory, founded in qualitative exploratory methodology that has been used in isolation previously. In this study SCT showed that the regression analyses supported SCT as a model for understanding all three behaviours in this population. NPT provided useful insight into coherence and cognitive 'buy-in' processes important for intervention design, differentiating the perspectives of each profession, which is important when considering an intervention that involves inter-professional teamwork. The combination of SCT and NPT proved an insightful partnership and should be considered in future behavioural questionnaire design.

5.5 Conclusion

This chapter has identified behavioural and organisational correlates of best practice dental clinician behaviour in the context of diabetes and periodontitis. All three of the dental professional groups were aware of the links between diabetes and periodontitis, and there was high uptake of *informing* patients with diabetes about the links between diabetes and periodontitis and *considering* the impact of periodontal treatment on the patient's glycaemic control. It was not clear whether the respondents had awareness of best practice guidance documents, however there was poor uptake of *contacting*, particularly among GDPs and DHTs. Qualitative findings suggested past problems with this behaviour, particularly from DHTs who had *contacted* GPs previously. Generally dental clinicians reported preferring to communicate with the GP through the patient or 'indirectly'. These findings suggest that training to develop self-efficacy, especially among DHTs, could be a useful approach to take to improve inter-professional working. The findings of this chapter and the previous one (Chapter 4) inform the oral health intervention design and development work described in the next chapter.

Chapter 6

Chapter 6: Oral health intervention development

6.1 Background

Findings described in Chapters 4 and 5 suggest that a person with diabetes is likely to be informed about the links between diabetes and periodontitis if they visit a dental professional, but not if they visit a primary care medical professional. Medical professionals, particularly nurses, have an important role in informing patients with diabetes about the links between diabetes and periodontitis and suggesting they go for a dental check-up, particularly for patients who do not attend the GDP. Chapter 4 found that in order to enable uptake of these behaviours interventions should aim to raise organisational understanding of the links and the purpose of carrying out these behaviours and also individual understanding (in nurses in particular) of how they will affect the nature of their clinical interaction.

Furthermore, the self-reported dental survey findings described in Chapter 5 showed poor uptake of the best practice recommendation to contact the patient's GP with regard to their poorly controlled diabetes and periodontitis. Notwithstanding, the behaviour was valued although many respondents expressed a preference for discussing glycaemic control with the patient themselves as opposed to contacting the patient's GP, thereby not adhering to best practice recommendations (British Society of Periodontology 2016b, Department of Health 2017). As previous research has shown a division between dental and medical professionals in the context of management of diabetes and periodontitis (Bissett *et al.* 2013), there was uncertainty as to whether the decision for dental professionals to not follow this best practice recommendation was another manifestation of a professional divide or a pragmatic modification made by primary care clinicians.

Various best practice dental recommendations recommend referring patients with suspected diabetes to their GP (British Society of Periodontology 2016b, European Federation of Periodontology 2012, Sanz *et al.* 2018a); and there is an emergence of studies reporting screening for dysglycaemia in dental settings (Glurich *et al.* 2018, Lalla *et al.* 2015, Lalla *et al.* 2011, Teeuw *et al.* 2017, Wright *et al.* 2014). NICE PH38 guidelines for the prevention of type 2 diabetes and identification of those at high risk recommend using a validated questionnaire to assess risk in settings other than medical practices, including dental settings (National Institute for Health and Care Excellence 2017). The DoH toolkit for prevention (Department of Health 2017) and the NICE PH38 guidance (National Institute for Health and Care Excellence 2017) include the option to use a template GP referral letter (Appendix 1 and

3); however the value of these templates to dental professionals was unknown and considered worthy of further exploration within the context of inter-professional communication.

The UK MRC guidance on the development and evaluation of complex interventions recommends careful development (informed by theory), testing and refinement of interventions (Craig *et al.* 2013). This chapter describes the development of interventions to enable medical professionals to inform their patients with diabetes about the links between diabetes and periodontitis, in addition to exploring issues surrounding inter-professional communication.

6.2 Methods

Iterations of workshops were arranged with a range of stakeholders to collaboratively explore and develop interventions including the screening of diabetes in those suspected to be at high risk.

6.2.1 Delivery of the workshops

The workshops were informed by the quantitative and qualitative survey self-reports (Chapters 4 and 5), together with previous qualitative work (Bissett *et al.* 2013) and discussions arising from presentations to patient groups and care providers. A workshop schedule was produced to inform and guide the discussions (Appendix 9). At the beginning of the workshops, it was made clear that the medical profession's general lack of awareness regarding the association between diabetes and periodontitis was understandable, given that medical and dental professions have separate training, journals, post-graduate education and conferences, all of which inhibits the sharing of knowledge and emerging evidence. This was done purposefully to marshal support and reduce defensive attitudes within the workshops. As self-efficacy was a significant predictor for suggesting that patients go for a dental check-up (as identified in the survey work in Chapter 4), and scores for specification coherence items for both individual and communal understanding were low, a summary of the key components of the association between the diseases was also explained to provide context for discussion at the beginning of the workshops. Key concepts were introduced via PowerPoint slides (Appendix 10) to illustrate potential intervention vignettes which stimulated discussion. The aim of the workshops was to explore acceptability and feasibility of the interventions. The workshop participants were encouraged to talk freely around each of the vignettes and interventions, and although a schedule was set in advance, the discussion was participant-led. Subsequent workshops began with a summary of the results of the previous workshop. The participants were asked to comment on the three interventions in terms of acceptance and

feasibility from their perspective, and indicate aspects of intervention design that they considered could enable and or hinder their implementation. The discussion concluded with a recap of the main discussion findings (delivered by the workshop facilitator, SMB), ensuring an accurate representation of the discussion, which also allowed the participants an opportunity to reflect on their contributions and refine their comments should they wish to do so.

6.2.2 Recruitment and data collection

As previous qualitative work identified a division between the dental and medical professions within the context of diabetes and periodontal management (Bissett *et al.* 2013), the workshops consisted of primary care dental professionals separated from primary care medical professionals separated from patients/carers/public. Separation of focus group participants according to profession or power dynamic was recommended by Krueger and Casey to help ensure that participants who may have conflicting opinions are at ease and to avoid those in perceived positions of power (e.g. the clinicians) dominating the discussion (Krueger and Casey 2015). Separation of professional groups for focus group work was also used by Lo et al, in their qualitative exploration of communication between GPs and tertiary HCPs in the context of diabetes and chronic kidney disease, in order to prevent a biased discussion (Lo *et al.* 2016). Whilst the workshops contained a mixture of clinicians from the same profession (GPs and nurses; GDPs and DHTs), the separation of patients and HCPs intended to create a comfortable (familiar) and uninhibited space for discussion.

The NENC CRN distributed a study summary to research-active dental and medical practices in their region and interested parties were invited to email an expression of interest to the researcher. Initially, three workshops lasting approximately 30-60 minutes were held with participants recruited from dental and medical primary care practices, and an oral and dental patient/carer/public involvement group at Newcastle University School of Dental Sciences. A further three workshops were held for each cohort to understand consistency and diversification of findings. Workshops were held at lunchtime either in the practice, or in a seminar room in Newcastle University. Travel expenses, gift cards and remuneration of HCPs' salary according to NIHR AcoRD guidelines incentivised participation. Participants were provided with written and verbal information about the study prior to signing consent forms. The recruitment period ran from September 2017 until January 2018.

6.2.3 Reflexivity statement

The workshops were audio recorded and transcribed, and reflective notes were also made by the workshop facilitator (SMB). The participants were told initially that SMB was a researcher, although being a DHT was not kept hidden.

6.2.4 Data analysis

Data consisted of audio-recordings of the workshops and reflective notes made by the researcher (SMB). The audio recordings were initially transcribed through an external professional service and subsequently checked for accuracy against the recording. Thematic analysis (Braun and Clarke 2006) was used to identify common attributes within the data as it is used in a broad range of disciplines (Rapley 2011). Notable discussion points and specific comments of interest were noted from the transcripts and supporting reflective notes, and codes or key words were applied. Following completion of the sixth workshop the transcripts were revisited and a process of re-reading (whilst listening to the audio) enabled application of the constant comparison method to revise the codes (Glaser and Strauss 1967). Emergent patterns and resultant themes were formulated via an inductive approach to the data analysis. Quotes which illustrated concepts relating to a particular theme were considered in detail and unpacked to explore meaning and develop better understanding. Analytical discussion during research meetings with supervisors provided the opportunity to further explore and clarify the emergent themes. NPT further provided a theoretical framework for analysis of the study's findings (May *et al.* 2007b) as used in previous implementation studies with patients (Gallacher *et al.* 2011) and HCPs (Scantlebury *et al.* 2017). There are four NPT constructs (Table 4.1): coherence, how people make sense of the behaviour or intervention; cognitive participation, how people get involved and stay committed; collective action, how people make it work in practice; and reflexive monitoring, how people assess whether it is worth the effort.

6.2.5 Regulatory approvals

A favourable ethical opinion was obtained from the North West – Greater Manchester West Research Ethics Committee (REC# 16/NW/0030). R&D approval was granted by the Newcastle upon Tyne Hospitals NHS Foundation Trust, who acted as sponsor for the research (R&D# 07394). The project was registered on the NENC NIHR research portfolio (Portfolio# 20477).

6.3 Results

The results are presented as follows: the ideas for the oral health interventions; followed by the four broad themes that emerged from the development workshops; and then finally the feasibility and acceptability of the interventions mapped onto NPT constructs.

6.3.1 Development of oral health interventions to be delivered in a medical context

The initial ideas for oral health interventions were conceived through discussion inspired by a diabetes and periodontitis presentation (by SMB) to a primary care medical practice in the North of England. The clinicians (four GPs and two nurses) were shocked that they did not know about the links between diabetes and periodontitis and expressed genuine surprise at the potential to reduce HbA1c with periodontal treatment, a non-pharmaceutical intervention. When asked how they would feel about informing patients with diabetes about the links, they agreed that this was something they would consider and discussion progressed to how this might best be conducted within their practice. The PN, who was carrying out the diabetes reviews, led the discussion suggesting that they could ask the patient when the last time they saw their GDP was, and this could be followed up with a brief description of the links and provision of a leaflet explaining things in more detail (Appendix 11).

Three interventions emerged from that discussion (Table 6.1), each based around informing patients about the links between diabetes and periodontitis in the context of their diabetes review appointment, with a dialogue initiated by the question: "When did you last see your dentist?" As this was a novel component of the diabetes review, it was decided that a prompt for the medical staff would be useful, and this could be achieved by adding the question to their diabetes review template. In the scenario of the patient having not seen the GDP for some time, the clinician could direct the patient to the NHS Choices website [https://www.nhs.uk/Service-Search/Dentists/LocationSearch/3] for a list of the closest NHS dental practices. This intervention was considered short and simple by the rest of the clinicians and unlikely to introduce complexity that could lengthen the review appointment. Henceforth, this intervention was to be introduced as 'Discuss and refer to a GDP' in the workshops (Table 6.1).

As the local NHS dental provision in the area of the practice was felt to be poor (anecdotal comments from the medical practice staff), the likelihood of a patient with diabetes not having attended the GDP for some time was predicted as likely to be high. Furthermore, it was recommended in the IDF guideline on oral health for people with diabetes (Table 3.1) that it may be useful if medical staff assess for periodontitis risk in their patients with diabetes,

through dialogue regarding the oral signs and symptoms (International Diabetes Federation 2009). As consultation time pressures in primary care medical practice are great, it was felt that there would be little time to discuss dental or periodontal issues in detail, but the idea of assessing periodontal risk with three short questions was considered worthy of consideration. This intervention was referred to as 'Discuss and assess periodontal risk' in the workshop discussion (Table 6.1).

Table 6.1 Intervention vignettes informing workshop discussion

	Intervention vignettes
Discuss and refer to a GDP	1. Change annual diabetes review template on IT system to include: "When did you last visit your dentist?" 2. Patient has a GDP? – go to 4. 3. No GDP? - refer to NHS choices website, insert postcode for nearest NHS dental practices 4. Inform about links using suggested brief script: "Gum disease is a complication of diabetes, like eye and feet problems etc" "Gum disease can affect your glycaemic control" "Treatment for gum disease can potentially improve HbA1c by up to 4 mmol/mol" + Hand patient a leaflet (Diabetes Research Wellness Foundation)
Discuss and assess periodontal risk	Same as 'Discuss and refer to a GDP' but if the patient has not seen a GDP for some time, ask three questions to assess oral health risk: 1. Have you ever been told by a GDP that you have periodontal disease (the name for advanced gum disease)? 2. Do you have loose teeth/have you lost teeth because they became loose? 3. Do your gums bleed after brushing your teeth?
Discuss and refer to a DHT team member	Same as 'Discuss and refer to a GDP' but if the patient has not seen a GDP for some time recommend they see the visiting DHT who can carry out a quick/simple oral health risk assessment.

Note: GDP, general dental practitioner; DHT, dental hygienist/therapist.

An idea for a third intervention arose from concerns expressed by some medical practice staff that the periodontal risk assessment may introduce unwanted complexity. If the nurse was able to signpost the patient to a DHT for a periodontal (or oral health) risk assessment, this could reduce unwanted lengthening of the diabetes review appointment with the nurse. The inclusion of a DHT into the diabetes MDT within the medical practice might also improve communication between medical and dental professionals. Thus, a third intervention 'Discuss and refer to a DHT team member', would include a referral to a DHT should the patient have not seen a GDP for a while; and the DHT would ideally visit the medical practice on the day of the diabetes review clinic, such as is routine for dietitians or podiatrists who may visit medical practices on specific days. The assessment by the DHT would consist of asking questions to gather information about the patient's medical and dental history and any symptoms they may be having; and if periodontal disease was suspected, a brief examination would be offered using a head torch, mirror and probe. The aim of the assessment would be to assess risk of periodontal disease, to provide advice and information about periodontal treatment, and how such treatment could be accessed (Table 6.1).

6.3.2 Iterations of workshops

A total of six workshops were held (Figure 6.1). The primary care dental and medical practice demographics are shown in Tables 6.2 and 6.3; and the participant demographics of the two patients/carers/public workshops are shown in table 6.4.

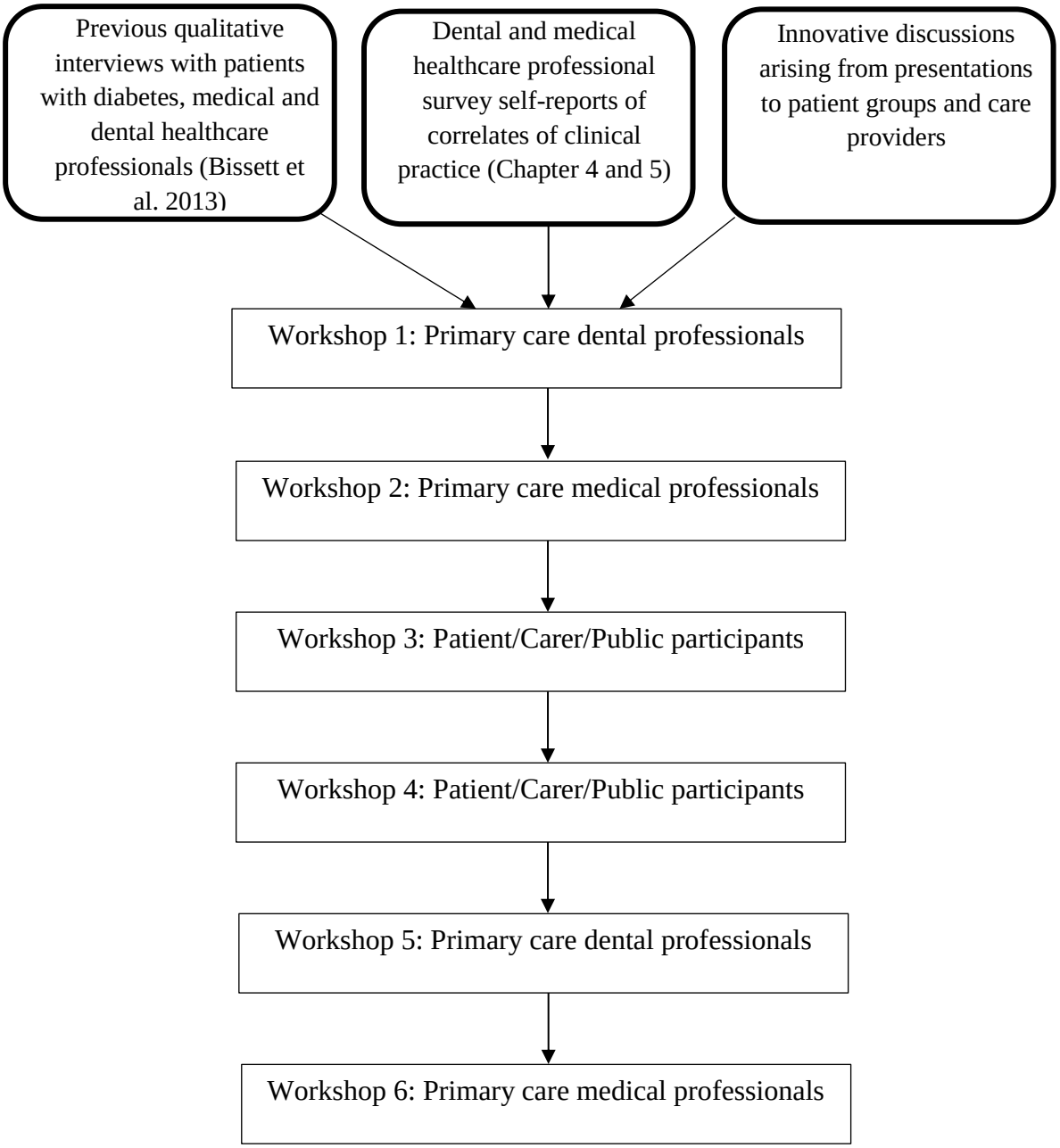

Figure 6.1 Overview of data sources and iterations of workshops.
Figure showing the data sources that informed the first workshop and intervention vignettes which were subsequently discussed for acceptability and feasibility in the six iterations of intervention development.

Table 6.2 Primary care dental professional workshop recruitment

		Workshop 1	Workshop 5
Practice-level details	Location	Urban	Semi-rural
	Size/number of patients	25,000	20,000
Participant-level details	Number of participants	8	6
	Male	2	1
	Female	6	5
	GDP	4	1
	DHT	4	2
	DN	-	3

Note: GDP, general dental practitioner; DHT, dental hygienist/therapist; DN, dental nurse.

Table 6.3 Primary care medical professional workshop recruitment

		Workshop 2	Workshop 6
Practice-level details	Location	Rural	Semi-rural
	Size/number of patients	5,500	7,300
	Percentage of patients with diabetes	4%	16%
Participant-level details	Number of participants	8	9
	Male	2	2
	Female	6	7
	GP	6	3
	Nurse	2	3
	Practice manager	-	1
	Administrator	-	2

Note: GP, general practitioner. %, percent.

Table 6.4 Patient/carer/public workshop recruitment

Participant details	**Workshop 3**	**Workshop 4**
Number of participants	6	6
Age range (years)	43-75	22-64
Male	2	2
Female	4	4
Working	2	2
Retired	4	4

6.3.3 Broad themes emerging from the analysis

Four common themes emerged from the analysis of the qualitative data from the six workshops: (i) 'owning (reliable) knowledge' which included concepts associated with the unknown, partially known or fallibility of information; (ii) '(mis)communication and proxies', including the use of proxies for convenience or as a means of avoiding undesirable communication; (iii) '(easily) accessing appropriate care' or the importance of an uncomplicated referral process and access to care; and (iv) 'ownership and responsibility' or task-role compatibility.

- *Theme 1: Owning (reliable) knowledge*

A lack of awareness or limited understanding of various topics arose from the workshops. Neither the patients nor the medical and dental teams were aware of the NICE PH38 guidelines, and the template referral letter was something that the medical teams had never received from dental clinicians. This, coupled with the medical teams' lack of knowledge or awareness regarding the mechanisms which link diabetes and periodontitis, made them curious about dental professionals' knowledge on this topic.

> I've never had anyone who's been sent to me by a dentist saying, "I've been told I need to tighten up my diabetic control". What is their awareness of the links between periodontitis and diabetes? Or what's their ownership of it? 'Cos you know … work[ing] in silos … where, 'it's a dental problem, not mine', but obviously, it's very joined together. (Medical professional, W2003: 669-676).

This participant was frustrated that they had not heard of the links between the two diseases from a dental professional before, either directly or indirectly. They clearly felt that the bidirectional links between diabetes and periodontitis necessitated inter-professional working that should have been initiated by dental professionals. The dental teams reported that they were aware of the links between diabetes and periodontitis, but there were accounts that some dental patients did not like to be asked questions regarding their medical history: "Well, nothing that concerns you, it's my teeth I'm here for" (Dental professional, W5006: 676). Furthermore, some dental participants made reference to inadequate understanding regarding diabetes which may affect their patient consultations.

> I wouldn't know to that, sort of, depth ... like things like your HbA1c, it's not, I know the term, but I don't know it in and out, 'cos [because] it's just not something that ... I would have to probably look it up, just to inform myself a little bit. (Dental professional, W108: 150-153)

Variations in knowledge and understanding were further discussed with anecdotal reports of inconsistencies in undergraduate dental curricula and teaching being described in the dental professionals' workshops. Notwithstanding, the evidence linking diabetes and periodontitis began to emerge in the mid to late nineties which could also affect the reliability of knowledge of dental clinicians, should they have qualified more than twenty years ago. Both dental teams claimed they had never heard of recommendations in this context, including the recommendation to contact a patient's GP in the context of their poorly controlled diabetes and periodontitis. They reported that any discussion regarding diabetes and periodontitis was generally between the dental professional and patient which, even in light of the guidance to contact the patient's GP, was preferred.

> If patients start talking in terms of their HbA1c, that's great, that gives you a much better, idea but I don't think there's that many, in my experience, not that many patients who are in tune with that… so you're not really sure how well it's being managed or not, and neither are they probably for that matter..' (Dental professional, W1003: 85-88).

Both medical and dental teams acknowledged that the patient may not always be a reliable authority on the subject of their diabetes control. Perhaps the patient may wish to avoid an uncomfortable conversation about the stability of their blood sugars, or they may want to assess the effectiveness of their efforts by comparing their results to those of their last review: "Is it better doctor, is it worse?" (Medical professional, W6009: 883). The complexity of diabetes was acknowledged when a nurse spoke about the vast array of numbers that can be discussed in a diabetes review appointment: blood pressure, cholesterol, HbA1c and those

relating to medication dosage. Reasons aside, the clinicians seemed to accept the fallibility of patient report as an unavoidable aspect of patient consultations.

- *Theme 2: (Mis)communication and proxies*

In relation to inter-professional communication, the NICE PH38 guidance was discussed, and the medical teams stated that they rarely received letters from dental teams, but on the occasions when they did receive communications, they often considered them inappropriate, for example, they might receive medication dosage queries prior to the GDP performing oral surgery procedures such as dental extractions.

> If they're on warfarin [anti-coagulant therapy], "what is the advice about warfarin for doing surgery", that's what they ask. (Medical Professionals, W6007: 740-741).

The medical teams were not comfortable offering advice on such matters and felt that the queries would be more suitably directed to the GDC or the BDA, or some such organisation aligned to dentistry. One medical team also expressed frustration at the referral of patients with dental pain for antibiotics.

> We've had them in the last few weeks again where they've [the patient] had a problem, they've contacted the dentist and they've been told ... "Oh, go to your doctor, we've ... he'll give you antibiotics". We don't prescribe [in] that [scenario], no we won't [give antibiotics]. (Medical professional, W6009: 630-645).

The staff in this (medical) practice reported a long history of patients attending with dental problems and poor access to dental services in their location, despite the NHS Choices website indicating the presence of two NHS dental practices within a five mile radius. The medical staff were not sure which dental practice were guilty of referring the current stream of patients to them for antibiotic prescriptions and they were unclear as to the exact quantity or frequency of referrals.

Miscommunication between medical and dental professionals was reported by the dental teams also. They reported negative experiences of contacting the GP with either no response or a dismissive response, which they perceived to be a result of the GP's indifference to this topic area.

> If we make the referral, it's not usually very well received at all. I think they, if I, and again, this might be unfair but I think there's a perception they think we're interfering or we're, we're stepping beyond our remit … I think they don't probably appreciate, they don't appreciate this link, but I think they also don't appreciate, the

> level of understanding that as a professional group, we have, of how, if you like, our world impacts in the greater systemic world.' (Dental Professional, W1003: 357-365).

When the medical teams heard about the dental teams' negative experiences of contacting GP practices, they seemed genuinely surprised. Both medical teams rallied to suggest a solution that may improve the referral process and indicated a preference for indirect referral through the patient, as opposed to a letter that would require administration and therefore time/manpower.

> I think that's the easiest way, we've got hairdressers sending us patients, chiropractors do…if the dentist said, "Go and see your doctor, 'cos I think these two are linked", they would come, some of them would come…we probably wouldn't be that responsive to a letter, but if they use the patients as the vehicle, it's their body, and then the ones that are interested would come.' (Medical Professional, W2003: 787-802).

This referral by proxy of patient was also preferred by the dental teams. They said that, despite some of the published guidelines stating that they should contact the patient's GP, they would normally ask the patient about their diabetes and glycaemic control and were generally happy with this system. The unreliability of patient report (as reported in the previous theme) was acknowledged by the workshop participants, but it did not seem to motivate the dental teams in any particular way to then contact the patient's GP. In addition, dental teams remarked that they were happy to refer a patient with periodontitis to their GP with suspected diabetes, they had experience of doing this albeit without knowledge of the NICE PH38 guideline, however the method used was, once again, by patient proxy for formal referral.

> I didn't contact their GP, but we advised them to go and get tested and they did. (Dental Professional, W1007: 269-270).

Both medical and dental team's justification of using the patient as proxy for referral was that it was the responsibility of the patient to arrange to see the GP to be investigated for diabetes and that it empowered the patient to take ownership of their health.

> I've never formally made a referral … I suppose really, you know, once again it's ... a bit of thinking, is it easier for the patient just to make that call themselves, and go and do it themselves but, you know, certainly, I think as well, I'm not sure, based upon the times I've contacted GP's to ask for blood tests, you know, when it might be you have a suspicion of anaemia or other things … they're not really ve[ry], in my opinion, not particularly receptive to that. (Dental Professional, W1003: 277-288).

The dental teams did not expand on the reasons why the medical teams may be dismissive when contacted, other than to suggest that they considered the letter or contact irrelevant, and were equally surprised to hear that medical teams were participating in the workshops with enthusiasm. Notwithstanding, the dental teams considered the NICE PH38 diabetes risk questionnaire and associated referral template letter especially appropriate for use. Although the template referral letter was a proxy for a letter penned from the GDP themselves, it was seen as acceptable as it was produced as a result of the partnership of NICE with Diabetes UK, and it contains key evidence in a footnote for GPs (Appendix 3). This was seen to raise the profile of the referral, making the source seem more official and therefore perhaps harder to dismiss.

> I think this letter in particular is quite good because, it's got the notes to GPs on the bottom which is all evidence based, so they're going to respond to that 'cos it, they, but if it's just a letter from us, like I say, like Gary says, I've had the same sort of experience where they're a bit dismissive of it... (Dental Professional, W1001: 489-491).

The medical teams were equally surprised to hear that there was enthusiasm from dental teams for carrying out diabetes risk assessments on their patients in accordance with NICE PH38 guidance, as there was a suggestion that GDPs would be less inclined to give the time to carrying out such diabetes risk assessments.

> Have you, have you shown this to some dental associates and asked if they would be prepared to give up their time, to get this filled in rather than getting the next patient in and getting some more money? And they are? (Medical Professional, W6007: 974-976).

There was also a remark from one of the patient/carer/public participants that GDPs are money orientated and keep appointments short in order to maximise earnings.

- *Theme 3: Easily accessing appropriate care*

Generally the workshop participants felt that the 'Discuss and refer to a GDP' intervention was 'good, quick and straight-forward'. Only one amendment was suggested which was that not all patients will have access to NHS Choices online, so having a printed list of NHS practices in the area to hand out to patients who needed it would be useful and may get the patient a step closer to actually making an appointment with the GDP. One medical team was really positive about 'Discuss and refer to a DHT team member' and, as they didn't have a specific diabetes review clinic in their practice, they felt that the referral would work in a similar way to referrals that they make to other allied health professionals (e.g.

dieticians/podiatrists/health trainers) who visit the practice, who operate via a separate booking system.

> But even if they weren't on site, even if it was, that the hygienist came once a month...and we said, "Oh, we can book, you can book in to see the hygienist, they come here once a month"... I don't know, you guys (workshop members) would know better, but I would expect that, they would love it. (Medical Professional, W2001: 531-544).

It was acknowledged that not everyone would take up the opportunity for an oral health risk assessment in the medical practice, but the medical team felt that there would be patients who were concerned about their oral health and they would find the assessment useful. The patient participants felt that if a patient had to return to see a DHT (rather than seeing them at the same time as their annual review appointment), then there would be little uptake of the service as they considered that a one-stop-shop approach to diabetes care was best. The other medical team considered the inclusion of a DHT into their team would be problematic due to potential over-demand as the dental provision in the area was historically very poor.

> ...'cos I don't know about you guys but I, am a bit concerned you might be absolutely inundated because the dental services aren't great around here, people are always worried about having to pay for it ... and if they see that there's something they're going to get free [laughs] … and by three o'clock we'll have a queue down the block ... then maybe, a queue going around, yeah. That is a concern. (Medical Professional, W6009: 432-445).

This medical team were also concerned about the ethics of offering a free dental assessment to patients who have unmet dental needs and the subsequent removal of the service when the pilot finishes.

> …potentially helpful, but problem is we're trying to push back where it is not funded, and so, if we, especially dental work, historically come to us, without any funding, and with no expertise on our part, so, if we start a service that potentially looks like dental service, people might think they can come... "Can I just make an appointment to see the [DHT]", and just go in. (Medical Professional, W6008: 462-480).

As this medical team were already frequently coping with patients with dental pain, many of whom were being referred by a local dental practice, a sense of isolation and lack of dental support was evident. Perhaps the idea of further facilitating dental care by offering an oral health risk assessment was considered an additional burden, yet one more thing that the medical practice would have to manage, even if the patients liked it and the take up of the service was good.

- *Theme 4: Ownership and responsibility work*

The medical teams' approach to diabetes care differed, with one team having a specific diabetes review clinic that was nurse led whilst the other team had no specific review clinic. Instead, in this medical practice, patients with diabetes were seen (by GPs and nurses) in amongst other consultations as part of routine outpatient clinics. The latter team, or more specifically, the GPs in this team, commented on their concerns about talking about dental disease, particularly with respect to adding time onto the clinic appointment by asking periodontitis risk questions.

> It's quite difficult to ask these questions and then just, let them be asked and then go, "OK, no more teeth talking" [laugh]. (Medical Professional, W2001: 359-360).

Both medical teams referred to the overwhelming nature of diabetes and the confining nature of appointment slots which are typically of very short duration. The patient participants felt that the 'Discuss and refer to a GDP' was quick and minimally disruptive, but felt that, all too often, a leaflet was given as a proxy for face to face consultation time with a HCP, and leaflets often end up in the bin, unread or misunderstood. They also felt that although the GDP was well placed to carry out diabetes risk assessments, there was a possibility that the patient would not receive the necessary level of support should they be told they were at high risk of having diabetes.

> …[dental] appointments are so short, you're 'in and out'…all they care about is getting the next person in, it's all about making as much money as possible. (Person with diabetes, W4007: 81-84)

On the topic of very short appointment times in primary dental care, both the patient groups and the medical teams reported that they felt that time constraints could be an issue in primary dental care that would prevent effective diabetes risk assessment in this setting. One patient participant commented that a diabetes risk assessment in a dental setting and a periodontitis risk assessment in a medical setting would not serve to join up the care from these two professions.

> …this intervention would not prevent silos of care, they would still exist. If the dentist refers you to your GP, you go there to get diagnosis, but if you have gum disease you still have to go back to dentist. They're still separate, they're treated in different buildings. (Person with diabetes, W4008: 172-173)

This sense of separated care was demonstrated by another patient participant who commented that although his medical practice staff were generally good with his diabetes management,

they would not be in favour of oral health interventions in the medical practice. This participant has been personally unsuccessful in persuading his practice (specifically, the GP and diabetes nurse) to start informing their patients about the links between diabetes and periodontitis.

> Well, I get a review twice a year...they're very good, they ask everything except for this topic. But, my doctor is now going to move up to the head of the practice, and as I say, he's violently against, anything to do with dentistry ... 'cos when I suggested that [putting up a poster], I think I told you, he nearly threw the computer at me … I can't see them allowing anybody in ... because they'll say, "Our receptionists haven't got time to organise this"... you know, they don't see the holistic, sort of, situation... (Person with diabetes, W3002: 1115-1138).

The patient participants claimed that none of them had been informed about the links between diabetes and periodontitis by their primary care dental practices, despite the fact that they had informed the dental professionals about their diabetes in their medical history screening. Some patient participants had only learned of the links between the two diseases when they had been referred to a secondary care centre for periodontal disease assessment and treatment, and had then been invited to participate in research on this topic.

There was much discussion regarding the design of the NICE PH38 questionnaire and, in particular, those relating to the BMI and waist circumference questions. Both dental teams expressed concerns about asking a patient about their weight, as it was felt that this could be a potentially awkward conversation and one that was not routine for the GDP/DHT, despite the upper weight limit on most dental chairs being approximately 127 kg with some patients being perceived as close to or exceeding that threshold. The avoidance of discussions regarding weight was echoed by the GPs who said they rely on the nurses to have such conversations because they can be off-putting for patients, just like conversations regarding alcohol or smoking, and nurses were perceived by the GPs to handle such matters with more sensitivity.

> I think most patients would think, "Well, I'm not going to the doctor then, 'cos they'll just tell us I'm fat and I need to lose weight"…it's a bit like the whole stop smoking thing, I'm not going to go there 'cos I know exactly the conversation we're going to have about that… the people who are most at risk are the ones that are least likely to come in, unfortunately.' (Medical Professional, W6009: 1077-1092).

Both dental teams were surprised to hear that medical professionals responded positively to being informed about the links between diabetes and periodontitis and valued the intervention work, and towards the end of the workshop, one dental professional suggested contacting

their Member of Parliament (MP), who is medically qualified and has previously expressed an interest in the links between oral and systemic health.

> Yeah. Actually, I mean diabetes is certainly one of the things in terms of their QOF points and stuff… is one of the big things that they get monitored on anyway, so....in theory, there's an opportunity for them to improve their kind of quality markers and stuff, if they…providing they see it in that light I suppose. Maybe we should contact our new MP [laughter]…he's a GP. He is. He's very…he's been here…he was very, very keen on looking at links between medical practice and dental practice. (Dental Professional, W1003: 767-789).

Although there was an initial perception that medical professionals were ambivalent to dental matters, there seemed to be a slight shift towards accepting that this may not always be the case.

6.3.4 The feasibility and acceptability issues of each intervention mapped to the four constructs of NPT

The three interventions, plus the NICE PH38 guidance which was discussed in order to explore inter-professional working, were mapped onto the four constructs from NPT, such as coherence (sense-making); cognitive participation (engagement); collective action (practice level participation); and reflexive monitoring (perception of effort/outcome ratio) (May *et al.* 2011)(Table 6.5).

Table 6.5 The four constructs of NPT mapped against workshop participants and interventions.

NPT Constructs	Interventions	Medical and Dental Professional and Patient/Carer/Public participants
Coherence: Do the interventions make sense?	Discuss and refer to a GDP	Medical teams were generally not aware of the evidence but the intervention made sense.
	Discuss and assess periodontal risk	Doesn't offer any benefit as the leaflet describes signs and symptoms of periodontitis.
	Discuss and refer to a DHT team member	Makes sense to medical teams as it is similar to referring to other AHPs involved in diabetes care, e.g. dietician.
	NICE PH38	No one was aware of the guidance but it makes sense.
Cognitive Participation: Do the participants engage with the interventions?	Discuss and refer to a GDP	Valued by medical teams as quick and simple to deliver. Some participants were strongly against the use of leaflets and would prefer direct communication with the HCP.
	Discuss and assess periodontal risk	Not valued by medical teams.
	Discuss and refer to a DHT team member	One medical team were against this due to fear of over-subscription and reliance. One medical team were very enthusiastic about it and thought their patients would love the opportunity.
	NICE PH38	Welcomed by medical and dental teams who especially like template referral letter. Some patient participants were concerned about the quality of support for patients who were receiving moderate to high risk score.
Collective Action: Do the participants think the interventions will work in practice?	Discuss and refer to a GDP	Medical teams felt this was appropriate for primary care (would offer little disruption) and could easily be integrated into consultations. Signposting to NHS Choices for local GDP or provide list for those who have not access to or prefer not to use the internet. One patient participant was sure that his medical practice would not engage with any discussion relating to dental matters.
	Discuss and assess periodontal risk	Would add too much time onto consultation.
	Discuss and refer to a DHT team member	Concerns over space as unoccupied rooms are limited in medical primary care. One medical team were concerned over huge subscription to this intervention that would cause the practice problems. Some patient participants felt this would only work in a one shop stop with DHT available on review day.
	NICE PH38	Medical teams and patients were surprised if GDPs would commit to this. Dental teams were not sure about calculating BMI and waist circumference.
Reflexive Monitoring: Do the participants consider the interventions as worthwhile?	Discuss and refer to a GDP	Seemed worthwhile.
	Discuss and assess periodontal risk	Not worth the effort.
	Discuss and refer to a DHT team member	Polarised view from 2 practices.
	NICE PH38	Considered an interesting idea, but potentially problematic due to issues with BMI/waist circumference and dental practices offering the appropriate support for patients who are identified as moderate or high risk.

6.4 Discussion

In terms of intervention development, the medical teams valued 'Discuss and refer to a GDP' due to the fact that it was perceived as being relatively quick and simple to deliver, which was important as the addition of any intervention would lengthen the already pressurised review appointment. In NPT terms it made sense and seemed worthwhile, primary care was clearly an appropriate place for it to be undertaken, and importantly, had 'interactional workability' in that it could be easily integrated into routine consultations and so would offer little disruption. The dental and patient workshops valued it also, with just one amendment being suggested which was to signpost to NHS choices or provide a print out of the nearest NHS dental practices for those with limited internet access.

'Discuss and assess periodontal risk' was not valued by the medical teams, as it seemed to offer little benefit over providing the patient with a leaflet which already contained information about the signs and symptoms of periodontitis. Notwithstanding, some of the patient participants felt strongly against the use of leaflets, seeing them as an inadequate substitution for face to face consultations, which may take longer, but would provide the opportunity to explore and support the patient's understanding of their periodontal condition and assessment of the resulting risk to hyperglycaemia. Medical teams expressed concern that despite there only being three questions, which would appear minimally disruptive, these would transform the 'Discuss and refer to a GDP' (which was briefly informative and signposting), into a lengthy consultation which could be difficult to manage. Notably, other studies exploring the challenges faced by HCPs in the context of providing evidence-based diabetes care, reported a feeling of conflict and being overwhelmed by the many complications of diabetes, whilst being restricted by short appointments which reduce the opportunity for education and prevention (Larme and Pugh 2001, Presseau *et al.* 2009).

The third intervention vignette, 'Discuss and refer to a DHT team member', was also generally accepted and offered the opportunity to task-shift oral health risk assessment from the GP (or nurse) to a DHT. The introduction of a DHT member to the diabetes care team, as a concept, was accepted by all workshops, but the potential for 'examiner' or 'operator bias' must be recognised as the researcher was a DHT (SMB). The use of task-shifting, or the delegation of a healthcare task to a less qualified yet competent member of the healthcare team, has been suggested as a way of improving efficiency of chronic care delivery and linked with cost saving; and periodontal assessment (and treatment) provided by a DHT as a member of a diabetes MDT, has been shown to work well in the literature (Pumerantz *et al.* 2017,

Seidman and Atun 2017). ‘Discuss and refer to a DHT team member’ was considered workable either if the DHT was available on the same day as the patient’s diabetes review, or if an appointment was arranged separately, which was consistent with the way patients access care from other allied health professionals aligned to diabetes care (e.g. the dietitian or podiatrist). The importance of easy access to care was emphasised by some of the patient participants who felt that the uptake of the intervention (or ‘success’ of the intervention) may be affected if the DHT was not present on the day of the review. Minimally disruptive care, where different aspects of care are focused and coordinated around patient’s visits, has been shown to be important in the literature (May *et al.* 2009). One medical team felt that they would not engage with the ‘Discuss and refer to a DHT team member’ intervention, despite recognising the value of it, due to the large unmet dental need in their patient population. They felt that the demand for oral health risk assessment would be so high, that it would cause operational conflict which would outweigh patient benefit. A reluctance to engage with a service designed to fulfil unmet patient need for fear of dependence has been reported previously in the context of multidisciplinary collaboration in diabetes (McDonald *et al.* 2012); and this perception was particularly accurate in this case, given the intervention would be evaluated by a small pilot and therefore not permanent.

The resulting intervention ideas are shown in the Template for Intervention Description and Replication (TIDieR) format as recommended by Hoffmann, indicating the ‘who’, ‘what’ and ‘when’ of the interventions as agreed following discussion relating to feasibility and acceptability (Hoffmann *et al.* 2014). Table 6.6 shows the ‘Discuss and refer to a GDP’ intervention and Table 6.7 shows the ‘Discuss and refer to a DHT team member’.

Table 6.6 'Discuss and refer to a GDP' described in TIDieR format (Hoffmann *et al.* 2014).

1	**Brief name:**	Discuss and refer to a GDP
2	**Why:**	1) To inform people with diabetes about the bidirectional relationship between diabetes and periodontitis 2) To refer them to a GDP for assessment, monitoring and periodontal treatment which can improve glycaemic control.
3	**What – materials:**	Addition of cue question to diabetes review template: "When did you last see a GDP?" Information leaflet (Appendix 9)
4	**What – procedures:**	1. Ask: "When did you last visit your GDP?" 2. Patient has a GDP – go to 4. 3. No GDP - refer to NHS choices website and issue a print out of the nearest NHS dental practices. 4. Inform about links using suggested brief script: "Gum disease is a complication of diabetes, like eye and feet problems etc" "Gum disease can affect your glycaemic control" "Treatment for gum disease can potentially improve HbA1c by up to 4 mmol/mol" + Hand patient a leaflet (Diabetes Research Wellness Foundation)
5	**Who provided:**	GP or nurse (PN or NP) who is carrying out diabetes checks (for newly diagnosed and for diabetes reviews).
6	**How:**	Generally face to face with individual patients, but could be over the phone if there are access problems (leaflet posted to patient).
7	**Where:**	In medical primary care settings. Access to leaflet and printer.
8	**When and how much:**	At newly diagnosed appointment and then at subsequent review appointments to remind the patient and clarify why it is important.
9	**Tailoring:**	If the patient does not have access to the internet, provide a list of nearest NHS GDPs with contact details.
10	**Modifications:**	Provision of list of nearest NHS GDPs for those who do not have access to NHS choices via the internet.
11	**How well – planned:**	Email communication with the DSN was difficult. The intention was for the researcher (SMB) to observe the intervention being delivered and recruit patients for an evaluation interview, but this could not be arranged.
12	**How well – actual:**	Evaluation for actual feasibility and acceptability was carried out by an interview with the DSN (Chapter 7).

Note: GDP, general dental practitioner; SMB, Susan Bissett (DHT researcher)

Table 6.7 'Discuss and refer to a DHT team member' described in TIDieR format (Hoffmann *et al.* 2014).

1	**Brief name:**	Discuss and refer to a DHT team member
2	**Why:**	1) To inform people with diabetes about the bidirectional relationship between diabetes and periodontitis 2) To refer them to a DHT team member for an oral health risk assessment and referral to a GDP as appropriate.
3	**What – materials:**	Addition of cue question to diabetes review template: "When did you last see a GDP?" Information leaflet (Appendix 9)
4	**What – procedures:**	5. Ask: "When did you last visit your GDP?" 6. Patient has a GDP – go to 4. 7. No GDP – refer to DHT team member for oral health risk assessment/referral to GDP. 8. Inform about links using suggested brief script: "Gum disease is a complication of diabetes, like eye and feet problems etc" "Gum disease can affect your glycaemic control" "Treatment for gum disease can potentially improve HbA1c by up to 4 mmol/mol" + Hand patient a leaflet (Diabetes Research Wellness Foundation)
5	**Who provided:**	GP, nurse (PN or NP) or HCA who is carrying out diabetes checks (for newly diagnosed and for diabetes reviews).
6	**How:**	Generally face to face with individual patients, but could be over the phone if there are access problems (leaflet posted to patient).
7	**Where:**	In medical primary care settings. Access to leaflet, printer and room for DHT assessment.
8	**When and how much:**	At newly diagnosed appointment and then at subsequent review appointments to remind the patient and clarify why it is important.
9	**Tailoring:**	If the patient does not have access to the internet, DHT (SMB) to provide a list of nearest NHS GDPs with contact details.
10	**Modifications:**	Provision of list of nearest NHS GDPs for those who do not have access to NHS choices via the internet.
11	**How well – planned:**	Planning went well and there was much enthusiasm for the intervention.
12	**How well – actual:**	Evaluation for actual feasibility and acceptability was carried out by an interview with the HCA and focus group with the other participants (Chapter 7).

Note: GDP, general dental practitioner; DHT, dental hygienist/therapist; SMB, Susan Bissett (DHT researcher)

Although not an intervention requiring development, the NICE PH38 guidance discussion allowed exploration of inter-professional collaboration in the context of undiagnosed diabetes. The guidance recommends diabetes risk assessment in a dental setting, with those identified as high risk being referred to their GP for investigation. The workshop members engaged with the guidance, with medical teams welcoming referrals (by patient as proxy for referral letter). However, some of the patient participants expressed concern that being informed of high risk could be interpreted as a diagnosis of diabetes, which could lead to tremendous anxiety for the patient. They also questioned the appropriateness of a dental setting, questioning the sensitivity and skill of the staff to provide sufficient support to a patient at this difficult time, either due to inexperience or lack of time. During both the medical and patient workshops, the perception that GDPs operate in a 'time is money' fashion was mentioned as it was considered a barrier to implementation of NICE PH38 guidance. How patients perceive their GDP or dental practice has been reported to affect dental attendance and it is possible that it also has an effect on attitudes of GPs referring to GDPs (Bissett *et al.* 2013, Sturrock *et al.* 2017, Zohoori *et al.* 2012).

The NICE PH38 guidance (and template letter) and the recommendations for best dental management of patients with diabetes and periodontitis (Table 3.1) (British Society of Periodontology 2016a, Department of Health 2017, International Diabetes Federation 2009, National Institute for Health and Care Excellence 2017) were not previously known to any of the workshop members. Successful introduction and implementation of guidelines can vary (Grimshaw and Russell 1993, Grimshaw *et al.* 2004) and poor adherence to guidelines has been previously reported in the literature with clinicians preferring to rely on tacit guidelines informed by experience, reading around the subject and peer discussion (Gabbay and le May 2004). Furthermore, best practice recommendations are not guaranteed to influence clinicians' behaviour. Previous studies have identified contextual and attitudinal barriers which prevented physicians from implementing diabetes recommendations in their qualitative study of diabetes (Presseau *et al.* 2009). Larme and Pugh found that physicians did not like to admit to a lack of knowledge or be told what to do. They were also reluctant to collaborate with other allied health professionals, particularly if there were accessibility issues affecting the referral process, leading to the use of indirect communication (Larme and Pugh 2001). And as outlined below, the patient is used as a proxy in this context.

The use of a template GP letter, such as the one recommended in the NICE PH38 guidance (Appendix 3), was considered useful and fit for purpose by some of the dental participants, particularly since it was designed by two trusted organisations, Diabetes UK and Leicester

University, and it included a footnote for the GP explaining the evidence. Template GP letters, like this one and the one produced by the DoH in their toolkit for prevention of dental diseases (Appendix 1), have been created for the convenience of the GDP. Notably, in context of poor communication (and for some previous unpleasant communications) they offer a substitute for a self-constructed referral letter. They offer GDPs a referral letter that has been designed by a trusted third-party so not only could it support the legitimacy of their concern, but potential problems with the design or structure of the letter would not be seen as their responsibility.

Accounts of miscommunication between medical and dental professionals were noted from all parties in the workshops and the challenges of inter-professional communication were pronounced. A lack of communication from dental professionals caused medical teams to defensively challenge dental professionals' claim on the links between diabetes and periodontitis, questioning their ownership of the links, particularly when this was clearly an area requiring collaboration. Dental participants' were aware of the links, but had not heard of the recommendation to contact the GP regarding their patients with diabetes and periodontitis. Notwithstanding, they explained their general reluctance to communicate with GPs, describing a history of no-replies or dismissive replies which were, at best, unhelpful and, at worst, offensive. Furthermore, negative associations regarding collaborative working between GPs and GDPs have been reported, such as perceived gaps in other HCP's knowledge, uncertainty of role and previous difficult interactions (Holzinger *et al.* 2016). Holzinger also reported frustration from GPs when asked by GDPs to advise regarding patients' anticoagulant therapy and dose adjustment for dental procedures, despite the existence of good quality guidelines, and a precise account of this was given in the medical workshops. Perhaps a query relating to medication, dose and adjustments would be more appropriately made to a pharmacist but, although there is an efficient referral pathway between GPs and pharmacists (particularly with regard to 'medication use reviews'), the equivalent does not exist for GDPs (Sturrock *et al.* 2017). Some GPs reported frustration when having to prescribe antibiotics for patients suffering with dental pain, particularly apropos antimicrobial resistance; and this has also been reported in the literature (Cope *et al.* 2015). It is noted that the occurrence of such a situation is exacerbated if the medical practice is located in an area with poor NHS dental provision, as reported in a study looking at the relationship between GPs and GDPs in Australia (Barnett *et al.* 2017) and this was the case for one of the medical teams in the workshops. Despite reports of inappropriate communications from GDPs drawn from two different scenarios, those relating to anticoagulant therapy and referrals for

antibiotics, it would appear these experiences occur with a certain regularity and perhaps the findings may be generalisable to a wider GP population.

Miscommunication between physicians and other allied health professionals in the context of diabetes has also been reported in the literature with barriers relating to power dynamics, uncertainty of role and distrust of inter-professional working (McDonald *et al.* 2012, Ohman-Strickland *et al.* 2008, Schweizer *et al.* 2017). Importantly, cooperation and collaboration work well when the HCPs are known to each other and the strength of this relationship has been associated with reduced healthcare costs (Holzinger *et al.* 2016, Lublóy *et al.* 2016). Schweizer suggested that perception about collaboration is important for collaborative work and the workshops explored this, with discussion featuring preferred mechanisms for communicating (Schweizer *et al.* 2017). Signposting a patient as proxy for direct communication (indirect referral) between professionals was mentioned repeatedly in the workshops. Suggestions were made that this was justified in terms of reducing administrative burden and encouraging patient empowerment, but it also negated the need for, previously described, direct communication between GPs and GDPs. Active signposting has been shown to be effective in the context of reducing the amount of inappropriate GP consultations by triaging patients to a more appropriate HCP (Siddiqui *et al.* 2017). Furthermore, it is recommended in the NHS Year of Care initiative for managing long term conditions (National Health Service 2007), however there is no evidence to suggest that signposting works in the context of inter-professional collaboration between medical and dental professionals and, in some ways, it may contribute to professional separation.

Obtaining information from the patients regarding their glycaemic control was preferred by the dental teams, despite concerns regarding the patients' understanding of their diabetes control and the reliability of the patient report by both medical and dental teams. Patients were described as being vague or using non-specific language which focused on levels of HbA1c relevant to their last review appointment. The reason for this was described by some medical participants as a symptom of the complexity associated with the treatment of chronic illness and the burden of diabetes therapy which has also been evidenced in the literature (Gallacher *et al.* 2013, Nam *et al.* 2011, Vijan *et al.* 2005). Rather than encouraging the dental professionals to contact the patient's GP for clarification, the suspected inaccurate or inflated accounts were accepted.

Although the dental survey self-reports found that dental professionals informed more than 90 percent of their patients with diabetes about the links (Chapter 5), the patient participants

challenged this, stating that they were never informed about the links when seeking dental care. Sandberg and Wikblad looked at oral health in relation to quality of life in patients with diabetes and reported that patients in their study thought that their GDP was unaware of their diabetes (Sandberg and Wikblad 2003). Furthermore, Hawthorne indicated a mismatch between what clinicians report providing, and what patients report receiving in their study of diabetes care provision in UK primary care (Hawthorne *et al.* 2012). Some dental participants described defensive reactions from patients when asked about their medication or medical history which were difficult to deal with. Other dental professionals alluded to a lack of understanding about HbA1c which had the potential to affect confidence in discussing glycaemic control with patients. Survey self-reports and workshop discussion must be interpreted with caution due to social desirability bias, with respondents potentially inflating past behaviour to appear more favourable. It is also noted that the integration of quantitative and qualitative methods can be problematic (Bryman 2007), with, at times, inconsistent or polarising results. Notwithstanding, having access to appropriate NHS dental and periodontal care is essential for patients with diabetes and, as one of the medical teams reported poor dental access in their area, it was clear that this could influence implementation.

6.4.1 Strengths and weaknesses

Six workshops (two with each cohort) enabled the perspectives of patients, medical and dental professionals to iteratively develop interventions to improve communication in the context of diabetes and periodontitis and explore further the complexities of inter-professionalism between medical and dental professionals. Development of interventions via workshop methods was considered appropriate as it would enable learning and broad discussion of the feasibility of the design and creative problem solving; however, the recruitment of HCPs (both medical and dental) to the workshops was problematic. HCPs are busy and it proved difficult to find people who were initially interested; who were then able to step away from their clinical commitments for the duration of the workshop; and who were available at the designated time. Thus, the decision to recruit on a practice level rather than an individual level was made and diversification was achieved through approaching practices from different demographic locations. The dental workshops were held at the practice during the staff's lunchbreak and the medical workshops were scheduled at the practice as part of their regular diabetes meeting; with refreshments and remuneration provided.

It is acknowledged that experimenter-expectancy effect may have been introduced, which could have influenced the data collection and analysis, given the researcher who facilitated the workshops and analysed the data was a DHT (SMB). The data and analysis were

discussed at various meetings with supervisors and members of the university progression panel and, as there were two workshops with each cohort, this allowed comparison of findings and assessment of reliability.

6.5 Conclusion

It is important that healthcare interventions are minimally disruptive to the work of busy clinicians and as the initial designs of the three interventions were created by medical HCPs, this may explain why there were very few amendments made during the development process. The overwhelming nature of diabetes was evident from both medical professional and patient perspectives which necessitated an intervention that was simple, and the 'Discuss and refer to a GDP' intervention was acceptable to everyone. The 'Discuss and refer to a DHT team member' was embraced by one of the medical teams who felt that it would be very well received by their patients; whilst the other medical team rejected it due to fear of dependence on a service which was a small pilot, indicating that this intervention may work in some practices whilst not in others.

The data from the medical and dental workshops were broadly consistent with the survey responses reported in Chapters 4 and 5; however, the patient members disputed the validity of aspects of the dental survey, saying that their diabetes (and links with periodontitis) was never discussed in dental appointments. Dental teams were enthusiastic to facilitate the identification of patients at high risk of diabetes, but patient participants were uncertain whether dental providers would be able to support their patients during the process, especially in light of a moderate or high risk outcome.

Inter-professional communication between medical and dental professionals in the context of the management of patients with diabetes and periodontitis was non-evident and there appeared to be little dissemination of best practice recommendations to a practice level. Both professional groups made anecdotal reference to negative experiences of communication between the two professions in other contexts; and the practice of sending the patient as a proxy for direct communication was seen as acceptable, despite the acknowledgment that it was fallible. Template letters may improve communication, particularly if endorsed by a recognised authority, such as those produced by Diabetes UK/NICE.

In the next chapter the interventions which were perceived as feasible and acceptable in the workshops were pilot trialled and evaluated for experienced feasibility and acceptability.

Chapter 7

Chapter 7: Trial and qualitative evaluation of feasibility and acceptability of oral health interventions in a medical context

As recommended by the MRC, intervention design and implementation should involve pilot trials and development work prior to a definitive trial (Campbell *et al.* 2007, Hardeman *et al.* 2005). The previous chapter (Chapter 6) described the development of oral health interventions and 'Discuss and refer to a GDP' and 'Discuss and refer to a DHT team member' were perceived to be feasible and acceptable. This chapter describes the pilot trial and evaluation of the experienced feasibility and acceptability of the interventions in primary care medical practice.

Hitherto, the apparent lack of useful inter-professional communication between medical and dental professionals has been discussed at length and remains of interest. Whilst the intervention development has focused on enabling medical professionals to inform and indirectly refer their patients to dental professionals, indirect referrals from dental professionals to medical professionals has been explored using the NICE PH38 guideline. Although never intended for evaluation within the timeframe of this study, the opportunity to examine such an indirect referral from the perspective of a patient was considered of value.

In recent years, NHS dentistry has changed, with many primary care GDPs moving away from the NHS and tailoring their services more towards private dentistry (or dental care covered by insurance schemes) or mixed NHS and private fee-per-item service. This has led to the perception that it is very difficult to find an NHS GDP, which can be demotivating for the public and a disincentive to those who recommend patients to actively seek NHS dental care (for example, medical professionals). The experiences of patients receiving and DHTs delivering periodontal management were thus far unknown and as such were considered worthy of further exploration.

The aims of the research described in this chapter were to:

- Trial and evaluate for feasibility and acceptability 'Discuss and refer to a GDP' and 'Discuss and refer to a DHT team member' from the perspective of healthcare provider and patient recipient;
- Evaluate the experience of a patient with periodontitis who was indirectly referred by their GDP to their GP for a diabetes assessment;
- Explore the experiences of patients and DHTs regarding the availability of periodontal services to those wishing to access them.

7.1 Methods

7.1.1 Recruitment

The interventions were trialled for feasibility and acceptability in two primary care medical practices in the North of England. The practices were approached which had participated in the interventions development (Chapter 6). The delivery of the interventions was discussed in practice meetings at medical practices in January 2018. During these meetings, the intervention was broken down (as shown in the TIDieR Tables 6.6 and 6.7) and the 'who', 'what' and 'when' of the interventions were discussed with the providers, whilst ensuring the interventions would fit in with existing systems to reduce disruption. Those involved in the intervention delivery were invited to a focus group (or interview) following the intervention trial, to evaluate determinants relating to the practicalities of embedding these interventions into routine practice.

Patients with diabetes were approached by their HCPs and invited for a telephone interview to explore their experience of receiving the interventions. A patient with periodontitis and suspected diabetes who was referred by their GDP to their GP was identified from a periodontal consultant clinic at a dental hospital in the North of England. They were invited for interview by the researcher (SMB) to evaluate their experience of indirect referral in the context of suspected diabetes.

DHT participants who worked in a dental hospital in the North of England with experience of delivering periodontal treatment and maintenance in a broad range of organisations were invited to a focus group by the researcher (SMB).

The primary care medical practices were remunerated for their participation in the focus group and interviews (according to their salary) as recommended by CRN. Referrals (£10 per referral) and room hire (£25 per session) were remunerated at a cost agreed with the practice by the researcher (SMB). The patients interviewed and DHT focus group participants were given a £10 gift card in appreciation for their time.

7.1.2 Data collection and analysis

Data consisted of audio-recordings of the focus groups/interviews and reflective notes made by the researcher (SMB). The audio recordings were transcribed by an external professional transcription service and subsequently checked for accuracy against the recordings. The interview transcripts were revisited and a process of re-reading (whilst listening to the audio) enabled application of the constant comparison method (Glaser 1965). All data were analysed

using thematic analysis (Braun and Clarke 2006) to identify common attributes within the data (Rapley 2011). Notable discussion points and specific comments of interest were noted from the transcript and supporting reflective notes, and codes or key words were applied. Emergent patterns and resultant themes were formulated via an inductive approach to the data analysis. Quotes which illustrated concepts relating to a particular theme were considered in detail and unpacked to explore meaning and develop better understanding. Data from the patients and medical professionals were mapped to NPT constructs (Table 4.1) to identify intervention determinants (May and Finch 2009). Analytical discussion during research meetings with supervisors provided the opportunity to further explore and clarify the emergent themes.

7.1.3 Regulatory approvals

A favourable ethical opinion was obtained from the North West – Greater Manchester West Research Ethics Committee (REC# 16/NW/0030). R&D approval was granted by the Newcastle upon Tyne Hospitals NHS Foundation Trust, who acted as sponsor for the research (R&D# 07394). The project was registered on the NENC NIHR research portfolio (Portfolio# 20477).

7.2 Results

Two medical practices were recruited that were involved in the development of the interventions (Chapter 6). The practices were from rural and semi-rural areas, but one had a four times greater percentage of patients with diabetes than the other (practice 2); and their organisation of diabetes care differed (see Table 7.1 for practice characteristics). Practice 1 did not have a specific clinic for diabetes management; rather, their patients with diabetes would initially be seen by the HCA who would take bloods and then they would be seen by the PN and/or GP for a review. Practice 2 had a diabetes review clinic which was led by a DSN practitioner.

The ‘Discuss and refer to a DHT team member’ intervention was delivered over a period of two months in practice 1 (February and March 2018); and the ‘Discuss and refer to a GDP’ intervention was delivered in practice 2 over a period of a month (March 2018).

‘Discuss and refer to a DHT team member’ intervention was evaluated by interviews with patients with diabetes who received it (n=2) (April 2018); and an interview with the HCA (who couldn’t attend the focus group) and a focus group with the other staff members (n=7) who were involved in delivery (May 2018).

‘Discuss and refer to a GDP’ was evaluated by an interview with the DSN practitioner who delivered it (n=1) (April 2018). The interviews and focus group explored determinants of the intervention. The characteristics of the patient recipients are in Table 7.2.

Table 7.1 Characteristics of the medical practices recruited

Practice	**Organisation of diabetes care**	**Intervention name**	**Healthcare professionals delivering intervention details**	**Location**	**Practice size**	**% patients with diabetes**
1	No designated diabetes review clinic. HCA takes bloods prior to review by PN and/or GP.	Discuss & refer to a DHT team member	5 GPs, 2 PNs and 1 HCA	Rural	5,500	4%
2	Patients seen in diabetes clinic by DSN.	Discuss & refer to a GDP	DSN	Semi-rural	7,300	16%

HCA: healthcare assistant; GP: general practitioner; DHT: dental hygienist/therapist.

The patient with periodontitis who was referred by their GDP to their GP for a diabetes assessment was interviewed during the month of June 2018. This interview aimed to explore the experience of an indirect referral from the patient perspective. The patient characteristics are shown in Table 7.2.

Table 7.2 Characteristics of patients who received interventions

Patient (ID)	Sex	Age	Intervention received	Intervention location	HCP who delivered intervention
Patient with diabetes (PI001)	Male	54	Discuss and refer to a DHT team member	Medical practice 1	GP
Patient with diabetes (PI002)	Male	59	Discuss and refer to a DHT team member	Medical practice 1	HCA
Patient with periodontitis (PI003)	Female	43	GDP refer patient to GP for diabetes assessment (NICE PH38)	Dental primary care	GDP

HCP: healthcare professional; HCA: healthcare assistant; GP: general practitioner; DHT: dental hygienist/therapist; ID: identifier.

The focus group consisting of DHT participants (n=5) was carried out in May 2018. This focus group explored the participants' experiences of treating periodontitis, particularly in primary care. DHTs rarely work full time in one practice and so although each DHT worked in secondary care in a variety of roles (including Staff DHT, Tutor DHT and Research DHT), they were all either currently working or had recently worked in primary care dental services (NHS and private) (Table 7.3).

Table 7.3 Characteristics of DHTs delivering periodontal management

DHT ID	Sex	Role in Dental Hospital	Experience in primary care
DHT01	Female	Staff DHT	NHS and Private
DHT02	Female	Staff DHT	NHS and Private
DHT03	Female	Tutor DHT	NHS
DHT04	Female	Tutor DHT	NHS and Private
DHT05	Female	Research and Staff DHT	NHS and Private

DHT: dental hygienist/therapist; ID: identifier.

7.2.1 'Discuss and refer to a GDP' intervention evaluation

The 'Discuss and refer to a GDP' intervention was initially introduced to the medical practice GPs and nurses (including the DSN) during a practice meeting, during which the steps of the intervention were explained. All staff were engaged and supportive of trialling the intervention and reported understanding what was involved. It was the DSN who delivered the intervention as she led the diabetes review clinic. She reported that although the intervention differed to her normal work, she valued it and considered it aligned with her role.

> Well, it's ['discuss and refer to GDP' intervention] just kind of part of the screening, and I think they're [the patient] just accepting it as part of the screening. We ask about their feet, to me, the mouth is less personal than asking them if they've got erectile dysfunction and, I mean, that's a question that's been in the templates for [a long time]… Um, so, to ask about their teeth is just, you know, another, and you can actually see as you're talking to them, you can see what state their teeth in and it gives you an opportunity, as you're going through your screening, just to kind of say, "Oh, the next question is about your oral hygiene". [HCPI01, 62-78]

The DSN was keen to continue delivering the intervention following the pilot trial and was confident in her ability to do so. She reported that the patients were accepting of it and it fitted in with self-management discussed at the diabetes review appointment. The practice adapted the intervention by photocopying the leaflet on diabetes and periodontitis (Appendix 11) so they wouldn't run out.

> …and it just, you know they seem to be accepting, not one of them said, "Oh, I've never been asked that before". Yeah, so they all seem quite happy just to, kind of, it's part of the screening that we're going to do every year. [HCPI01, 82-88]

The intervention seemed to fit in well with the diabetes review system in this medical practice. They had recently started to trial a new diabetes and cardiovascular screening template. Although the initial concept for the 'Discuss and refer to a GDP' intervention was to add a dental question to the diabetes/cardiovascular disease template to act as a cue for further discussion, since the template already had an oral care section in it, they just used that as a prompt.

> ...and it's fantastic, they're [the oral care section questions] in the, it's under the diabetic and cardiovascular screening, and it's got eyes, feet, kidney's, memory, mood, pregnancy, erectile dysfunction, alcohol and oral care…It's amazing, it really is, it's really good. [HCPI01, 244-254]

Collectively, the practice had recently signed up to the new diabetes/cardiovascular disease template to help with diabetes screening and identify any problems. The oral care section of

the template (Appendix 12) included questions regarding gums, mouth, teeth and oral hygiene. Furthermore, it had a tick box to indicate whether advice had been given on oral health and gum care, and advice to inform the GDP of diabetes and to have annual check-ups. The nurse seemed to just follow the questions on the template. Below she described exactly what she did:

> If they have got good hygiene, I don't really take it any further than that. If they've not got lots of cavities, if their mouth looks fine, if they're not identifying they've got any problems, if they're saying, that they have, um, a dentist and things like that, and they're registered with a dentist, I just leave it at that. If they are having problems with their teeth, then I go into a brief discussion around, um, how diabetes and the teeth, how it can be linked, how it can affect the results when their bloods are taken and what not, and they just seem to take it on, and you know, most of them have said , "Oh, it's just something that's on the to-do list, and, now that you've mentioned it, I must go and get it seen to". [HCPI01, 93-118]

The DSN did not report handing out the diabetes and periodontitis leaflet to every patient that she saw, but only those who had mouth problems. When asked about informing newly diagnosed patients about the links between the two diseases, the nurse suggested including the leaflet (Appendix 11) in a pack that they give out.

> I would get somebody that's newly diagnosed in to see me, go over diet, lifestyle, ask if they want to be referred to, you know the DESMOND education and I could, I give them all the leaflets about type 2 diabetes and the diet sheets and everything, I suppose I could put it in with that, when people come in. So I could certainly start doing that with the people that have, either have issues or, the newly diagnosed and just getting it in there straight away so it's something that they're thinking about. [HCPI01, 170-203]

This version of the intervention seemed to work very well for the DSN who reported that it did not appear to lengthen the review appointment or disrupt it in any way. Unfortunately, it was not possible to interview any of the patients who received this intervention, but according to her self-reported data it seemed that the patients were being informed about the importance of oral health in the context of their diabetes review.

7.2.2 'Discuss and refer to a DHT team member' intervention evaluation

This intervention was different to anything that the HCPs had previously delivered and that patients had received. Notwithstanding this, the medical practice had participated in the intervention workshop and staff were keen to be involved in the pilot delivery. There appeared to be good understanding of what was involved, indeed the PN stated that she was already informing the patients about the links between diabetes and periodontitis and had been

doing so since the development workshop. The HCA who saw the patients first to take their bloods could not attend the implementation meeting and was informed of the intervention by the diabetes lead GP through email and face to face conversation.

> It was Dr Brown, who said, would I mind, when I'm talking to patients who come for their diabetic bloods, would I mind asking them if they've visited a GDP, [and] how often? And if they didn't, would they be willing to have a chat with yourself [the DHT], or at least, consider taking a leaflet with them and having a read through if they were undecided. [HCAI02, 84-90]

In essence, the HCA found that the best time to deliver the intervention was when she was trying to distract the patient from having their bloods taken. This could be a stressful time for the patient, so instead of asking about the patient's holiday, for example, she would ask them about their GDP.

> Yes, um, it's what I call me twitter! I generally, twitter on to patients, 'cos some people are a bit nervous, even though they might have come for years, some people are still quite nervous about having their bloods taken because you're piercing their skin with a sharp implement. But, just usually when I was typing, up, bits and pieces I would say to them, "And do you visit a dentist?" And how often?" And it was just through the course [of the appointment] so it didn't take up any time at all really, because it was within the consult, so everyone gets 10 minutes. [HCPI02, 295-313]

The HCA did not go into details regarding the links between diabetes and periodontitis and it was not clear whether the GP asked her to mention the links or not. She asked the patient about the GDP and if they wanted to know more, she would hand them a leaflet or suggest that they could see the DHT for further information or advice. This signposting seemed to fit with her role, in contrast to the role of the PN who would undertake anything 'educational'.

> No, not at all. Um, they just basically came in, had their, they said they were here for their diabetic bloods before they saw Liz [the PN], or they had a, med [medication] review with the doctor. I would just take their bloods and, basically didn't really ask them any follow up questions about their oral hygiene, or anything or, because I didn't feel I could talk to them about, when they were talking about the right glucose, blood meters and things, that was more Liz's [remit], I was there basically just to take blood. [HCAI02, 103-114]

Generally, the HCA was happy to deliver the intervention as she believed that oral health was important and felt that it did not disrupt the consultation at all: "…it doesn't take a second to say and by the way, do you see a dentist on a regular basis?" [HCAI02, 404]. The GPs found it more difficult to deliver the intervention and became increasingly concerned about the small numbers of patients actually taking up the opportunity for a referral to a DHT.

> I mean, I don't know what Cath [the HCA] found, I have to say I think she did a much better job than I did about asking people, I think I did still find it hard to remember to ask them even with all the prompts and um, because usually they would come in with, you know, so many other things and um, but I don't know what Cath found, whether she found more interest, I don't think we had a massive interest did we at all? [GP, 167-173]

It was considered that perhaps the affluent location of the practice was a reason for low uptake of referrals to the DHT as many patients seemed to have a GDP and value regular dental attendance: "Oh yes..." you know, "...I agree with you, yes, I always see a dentist" [laughs] [GP, 90]. Furthermore, the patient would see the GP for review of their medication which could be complex and take the entire duration of the appointment. It appeared that the intervention did not align with the subject matter of these consultations and there was little time to discuss whether they had a GDP. If they did discuss it, it would make them run late. As time progressed, one GP felt a sense of urgency to refer someone to the DHT, as DHT sessions had been cancelled due to a lack of referrals, as described below.

> Yeah, yeah, it did. No, no, no, it definitely did extend the appointment 'cos ultimately I would bring it up, at the end, so, let's say it was medication review, and, or it was something else, and I'd be saying "Right, this guy is diabetic", especially as we were getting closer to the time of the sessions, and I was very conscious of thinking, "These are really empty sessions, can we find anyone to go into them?" Um, so, it would become, ultimately we would have to, it wouldn't add on, hours, but it would add on minutes to bring up the discussion of, "Do you see a dentist? Did you know this? We are doing this. This is an option", you know, like I say, it becomes, after you've said it a few times, it becomes a set thing set way of saying it, and they can easily cut you off if, "Oh no, yes, I have a dentist". Great. End of. "Did you see him recently? We recommend it". [GP, 351-385]

The low level of uptake of the DHT appointments by patients came as a surprise to the GPs as they thought it would be attractive to patients. Four patients who received the intervention did not have a GDP: two patients made an appointment to see the DHT; and two refused due to a phobia of GDPs/dentistry. One of the patients who was referred by the GP and seen by the DHT considered the intervention to be appropriate and valued having the opportunity to see DHT for oral health risk assessment as it was 30 years since he last went to the GDP. He was relieved to discover his oral health was relatively good and he had fewer problems than he thought he might. Despite a previous bad experience with dental local anaesthesia 30 years previously, the patient said he felt encouraged by his visit to the DHT to subsequently make an appointment at a local GDP that his family go to. However, at the time of the interview he had not yet made an appointment.

> Um, it was just the, he, examined us, for me diabetes and he mentioned there was somebody that comes in, and um, can, they can check your teeth for you, you know? Um, with, there's a connection with diabetes [and periodontitis] and I was very interested…when he told us. I haven't [been to the dentist] at the minute but I am going to. I have, um, I've been to work for the, you know, few weeks, but I am going to. It's, put me into a frame of mind that I, I'm going to, make an appointment and go to the dentist, definitely. [PI01, 19-67]

The second patient who was interviewed apropos the intervention was offered the opportunity to speak with the DHT by the HCA. He already had a GDP and had received treatment for periodontitis by a DHT, but he had not been for a while. He was not surprised by the links between diabetes and periodontitis as he considered that diabetes was linked to everything; and he felt that the intervention was appropriate to be delivered in the context of a diabetes review. The patient was, at the time of the interview, uncertain whether he would return to his GDP, as he had numerous complaints regarding his periodontal management which had resulted in him extracting some of his own teeth. Periodontitis can result in teeth becoming loose due to progressive loss of alveolar bone support and teeth can spontaneously exfoliate in advanced cases. Notwithstanding, the self-administered extractions were painful to various degrees, but the patient felt compelled to remove his own teeth due to a gradual breakdown of trust in his GDP, thereby placing a low value on the prescribed periodontal treatment. In his experience the treatment was costly and it did not appear to halt or slow down the deterioration of his periodontal condition. In the following account the patient describes the reason for not wanting to attend his GDP.

> Why, the last time I was in, to see her, I went in, she checked, checked me mouth and she says, "Right, make an appointment to see the hygienist". I don't think I was in, five minutes, if that, and, um, I made an appointment to see the hygienist, and I had a few more teeth then like, and she was polishing them, and um, "Oh", she says, "there's a couple of wobbly ones there and that", I says, "Aye, I know". So anyway she, she tried to clean them and that you know…[was in] maybe, 10 minutes if that…the last time I was there, the hygienist was about 30 pound or something, and I went in to see the dentist I think it was about the same again…They were coming loose. Then it was, you know, it wasn't doing nothing. I thought myself, what's the point of me ganning now, to see them, and paying this money for nowt. [PI02, 272-342]

The patient thought that he was paying for NHS treatment, but it appears that he was paying an additional sum of money for the DHT appointment which suggests that this treatment was private. The patient had tried talking to the GDP about his complaints and the GDP replied: "Well it's for your own benefit" [PI02, 377], but the patient did not agree.

7.2.3 Patient with periodontitis advised by their GDP to go to their GP for a diabetes assessment: experience of indirect referral

The patient described their experience of being recommended to visit their GP for diabetes assessment by their GDP. The patient had gone to her GDP for a routine check-up. On the occasion in question, the GDP expressed concern regarding her periodontal condition and suggested that there could be an underlying systemic cause. The GDP asked about smoking history and family history of diabetes and early tooth loss. As the patient was only connected with her maternal family (having never met her father) these questions were difficult to answer. The patient reported becoming increasingly upset as she had not experienced any problems with her teeth and was shocked and frightened when the GDP predicted that she could lose all her teeth in next 10-15 years.

> So then he said, "Well, I think you need, I'm concerned, you need to go to the doctor, I want you to get bloods done…It looks like, your jaw bone's receded", or there was another word for it. [PI003, 89-332]

The content of the discussion, and the language (and tone) used by the GDP, was distressing to the patient who reported crying when she relayed the details of the appointment to her mother and husband later that day. In addition to advising the patient to visit her GP, the GDP referred the patient to a DHT in the practice for periodontal treatment and also to the dental hospital for a consultant opinion. At no point did the GDP seem to discuss the links between diabetes and periodontitis or provide context for the referral to the GP; and apart from having periodontitis, the patient did not appear to have any other risk factors to suggest that she may have diabetes. The patient hoped for reassurance from her GP.

> I went to the doctors…and I says, "I've been to the dentist, he's really concerned about me teeth, um, me gums". She [the GP] didn't look in my mouth or anything…um, and I said, "he's wanting bloods taken for diabetes". And she said, she says, "I'll do them if you want me to do them", but she says, "I can tell, just looking at you, you don't, you haven't got diabetes". So, I insisted, I said, "Look, you know, I want to rule everything out, I want to get to the bottom of it, would you be able to make me an appointment with the nurse?" [PI003, 91-100]

The patient acted on the GDP's recommendation to go to the GP because she was frightened about her gums and that she may have diabetes. The GP did not offer reassurance, in fact their reaction made the patient more anxious. The patient was unable to provide information or explain the referral or connection between diabetes and periodontitis and described having to 'insist' on an appointment with the nurse/phlebotomist.

> I went in, the following week, and then, I was due an 'Over 40' check, which I hadn't had, so, that was quite lucky. The nurse said, "Look, I'll do you a diabetes check, and I'll also do bloods for all the other things that you normally get checked when you're over 40". So I thought, oh well that's quite good. So I got tested for just about everything I think, yeah, full bloods, full, liver, kidneys. All the works, I think. [PI003, 104-127]

The patient described feeling very scared about what the tests may show, but the nurse was very reassuring: "Well, I don't think you've got diabetes, but it's just as well you're coming in for a full check" [PI003, 378-9]. The wait for the results was difficult and the patient reflected on how the GDP had behaved. Not only had the GDP shown very little sensitivity (if any) to the patient during the appointment, they had also made no attempt to contact the GP themselves, and gave the patient no information to take to the GP to explain the connection between diabetes and periodontitis. The patient never suggested that the GDP was wrong to advise her to visit her GP, but the manner in which the GDP communicated was poor.

> So, I mean, at the time, I was a little bit upset with the dentist, 'cos I just thought he was having a bad day the way, he was with the, I mean I can't say he was nasty, but he, just he, and obviously he's been concerned and he has, you know he's been right in his diagnosis because there is something going on [with the periodontitis], so he's right to refer me [to the dental hospital]. [PI003, 135-145]

Although the referral to the GP ruled out diabetes and, fortunately for the patient, it prompted an 'Over 40' check-up which came back with good results, the patient was disappointed with the reaction of their GP. She had felt very apprehensive before the appointment and thought that the GP would understand the reason for her visit, and perhaps offer an opinion on the patient's gum health and generally make her feel better.

> Really [laughs] like nervous to be honest. I thought she would, actually put me mind at rest but, when I left, I just felt exactly the same because you know, she was adamant, I didn't have diabetes. And, she, she didn't really reassure me, you know, she didn't even look in me mouth, so, I know you can't see [the periodontitis], you know but, you know, I thought we, with her being the doctor, surely she'll know a little bit about it, about your gums and…[PI003, 304-323]

The GDP also referred (direct referral by letter) the patient to the dental hospital which also worried the patient. She had searched for information about signs and symptoms of periodontitis online and was unable to make sense of the information and how it related to perceptions of her oral health. She also reported considering changing her GDP. The patient also had concerns over being referred to the DHT which costs more money and initially suspected the GDP of trying to exploit her financially. It was suggested that although the GDP

is working in the NHS (£20 for the check-up), the patient was referred for periodontal treatment by the DHT at a private cost: "…I think it's about 50 quid a pop [a visit]" [PI003, 514].

> I was going to change the dentist and then I thought, well, I've, I had a word with my husband and he said, "Just, just stay with them, at the moment, get, get, get it all checked out at the hospital" and then, if I feel like I need to move I'll move when everything's settled down you know? But, I just, [laughs] my initial thought was it was, just a way to get money out of me 'cos, I pay for me, I pay for me treatment, there's been absolutely nothing wrong with me teeth, I haven't got bleeding gums and all this, and he was sending me, I wasn't in the chair five minutes, and he was sending me for two appointments for, deep cleaning…but, obviously, if I've got to go, I've got to go. [PI003, 145-177]

Overall, the intervention was disruptive to the patient who was frightened and alarmed by the GDP, and felt further anxiety due to the reaction of the GP. If the GDP had communicated with the GP personally, it would have informed the GP about the links between diabetes and periodontitis and provided context and justification for the referral.

> If my dentist, spoke to the doctor, or, or, or, along that lines, they might, I might have been a little bit more wiser, as to what was actually going on, but I don't think the dentist phoned the doctor or, letters were written or, you know, I don't think anything was, happening there. They just left me to do it on the, the dentist, he sent me to do it, you know, all on my own. [PI003, 402-426]

The GDP referred the patient for further investigation for both their periodontitis and suspected diabetes which could have made the patient feel looked after, but instead they seemed to feel confused, worried and isolated, being unable to get the reassurance and support that they needed.

7.2.4 DHT focus group: experiences of delivering periodontal management

The focus group explored the experiences of DHTs with regard to periodontal management in private and NHS primary care dental settings and secondary care NHS services. Four themes emerged from the analysis: system unfit for purpose; miscommunication within dentistry; misuse of dental services; unrealistic expectations.

- *System unfit for purpose*

Changes to NHS dentistry have resulted in many primary care GDPs moving towards private dentistry or mixed NHS and private fee-per-item service. This has led to the perception that it is difficult to find an NHS GDP, which can be a barrier to the public and those who recommend patients to actively seek NHS dental care. Thus it was considered important to

assess this perception with the DHT participants to better understand the accuracy of these perceptions from their point of view.

> There's not many people [dentists] that don't [accept NHS patients]. They're always advertising for more NHS patients…further south...the access to NHS dentistry…is not as good, so there's a lot more travelling. But I think in this area, we've got...I don't think there are any more UDAs available, in this area. [DHT03, 104-165]

In the participants' experience, access to an NHS GDP (for a check-up) was good, although they accepted that this may not be the same in all areas of the country. Whilst dental services available on the NHS are partially restricted (in terms of treatments that are funded by the NHS), periodontal treatment is available as part of band two provision (Chapter 2, Section 2.5). DHT participants were asked to comment on the patient accounts which indicated that despite having signed up to NHS care, their periodontal treatment was provided by a DHT at the practice (via referral from the GDP) at an additional (private) cost.

> When I worked in xxxx it was like that. It was an NHS practice, I went every Friday, and, the patients were all paying privately, to see us, and nobody, most of them, didn't know why. It wasn't explained to them. And…I don't think any of them [the dentists were] doing scale and polishes, it was solely me. And they [the patients] were all having to pay £25, for 20 minutes. I think if they questioned it, they would probably be seen by the dentist and have it done on the NHS, but most of them didn't question it, so they were just kind of just, shoved off, in my direction, which I felt really bad about, but it wasn't anything, it was out of my control, but it wasn't fair these patients were having to pay £25, for something that should have been offered [on the NHS] and then if they needed to come back for four appointments [for one visit per quadrant periodontal treatment, the cost was four times as much]…[DHT01, 352-371]

It appeared that in the DHTs' experience (which was consistent with the experiences of the patients), the GDP was referring the patient for periodontal treatment with the DHT, but failing to offer alternatives to the patient or explain that this service was outside of the NHS, and, in other words, was a private treatment. One DHT explained that, whilst not justifying this practice, a referral to a DHT incurs a cost to the GDP which is significantly greater if the practice is a corporate dental practice. This can make periodontal treatment (often needing multiple visits) very expensive and force the GDP to operate at a loss, if the treatment was to be provided on the NHS.

> And that dentist still has to pay, for the referral, even on the NHS, if they refer it to the hygienist. Because I know in practice, when, before we were a corporate, the [associate] dentists made this, this, stand…to pay, x-amount of money a month…[to] use the hygienist…but when we became corporate, they changed that and the

> corporate would charge, £7, per 15 minute slot, to the associate. So if you were trying to see, a perio [patient with periodontitis]…I will get two half hours, but they're still paying £28, to the corporate, for me to see that patient…so what their UDA value is, if they're having to do an examination, X-Rays, and any cons [fillings], as well as the perio [periodontal treatment] that I'm doing, they're going to be in negative. They're not going to be get-, they're not going to be earning anything, you know? [DHT03, 388-420]

Furthermore, the DHT went on to express their frustration with working in a system, that was described as 'not fit for purpose' and stressed that patients need to be assertive and question the GDP in order to push for what they want/need.

> It's not, I would agree, it's not fit for purpose and you feel as though, you [the DHT] strive to do the very, very best you can and you run yourself ragged trying to do it. And the thing is, the patients appreciate it, whatever you can do for them, they do appreciate it. And some of them will insist when they go back to a dentist, "No, I need to go back and see her". OK, fine, well just keep insisting. [DHT03, 537-568]

The DHT participants all agreed verbally or non-verbally that working in this system was frustrating and problematic, not just for themselves but for the patient also. Notwithstanding the constraints of primary care, it was acknowledged that a close relationship can form between the DHT and patient, as they are frequently united in their work to overcome (or stabilise) periodontitis: "I'm not having local [anaesthetic], I'm not having local, they [the GDP] mentioned local" (patient). "Well that's alright, we'll still be able to treat you, without the local" [DHT03, 1125-1126]).

- *Miscommunication within dentistry*

Numerous examples of poor communication between dental professionals were given throughout the focus group. GDPs communicated poorly with the DHTs, particularly by neglecting to explain about treatment already provided, which in the case of periodontal treatment, is not always clear to the observer. Auto-notes, a software tool used in some practices which provides templates to insert frequently entered text into electronic notes to quickly record what has been done and said (for example, during a check-up) exacerbated miscommunication, as the DHTs believed these were often inaccurate and did not represent a true account of what had occurred.

> Well I have a, I have a real problem with, one dentist in the practice I'm in at the moment. And, it's a case of, it'll be an advanced scale that's coming through, and it'll be two advanced, it'll be written in the notes, two advanced scales, but he'll have ticked the first one, I'll think, "Oh well what's he done?" And I've got, for RSI, duh

> duh duh duh duh duh duh. Been no indices done, no nothing… Why tick, you know, you haven't done anything? [DHT03, 1575-1591]

Another problem reported by the DHTs was inaccurate BPE scores which led to inappropriate diagnoses and treatment plans. As generally DHTs work to a prescription, this meant that the DHT would have to find the GDP, discuss and correct the prescription prior to carrying out any work, which would typically use up the appointment time, leaving the DHT to explain the need for further appointments and additional cost to the patient.

> I always used to find it difficult to explain to a patient that, yeah they've [the GDP] sent you and then you look at it and think, "Hang on, this isn't a simple scale and polish", so then you've got to go back to the dentist and say, you know, "I've done the BPE again, and,…" you know, "…the duh duh duh duh duh duh duh [there is deeper periodontal pocketing], right?" "Right, right, yeah , yeah". But then you've got to go back to the patient and say, "When I've had a look around", you know... "there's this and…", and you, then you start answering the question but, this should have all been sorted out and this patient should have been given the correct appointment initially. It's not, it shouldn't come from us, because then that makes us, it puts us in a difficult position, it doesn't make the practice look, efficient. And, if the patient has any sense they're going to say, "Why didn't they pick it up?" And that's really uncomfortable. And then you've got to explain that it's going to cost them, twice as much, or more. [DHT03, 1521-1554]

Miscommunication was also described between specialist services in the dental hospital and the GDP. Here is a description of a GDP who was critical of the discharge letter they had received from the dental hospital as it contained very little information regarding the periodontal treatment provided and the patient response.

> …So there's a dentist upstairs that works on clinic, I don't know what his name is, dark haired lad, he'd referred a patient in, to the hospital, he thinks the patient had been to see me but he's not too sure. He wanted me to get back to him, when the patient finished so he could see the patient's notes and have a look at his PPDs [probing pocket depths] and bleeding scores and stuff, just 'cos he feels like when he goes back, when the patients go back, they quite often get a referral letter sent back to them, no, a discharge letter and it doesn't have all the information in, so he's saying that sometimes by the time he sees them [the patient] again, after being here [the dental hospital], was their periodontitis stabilised and things were looking really good, and it's just kind of gone downhill again? Or did the patient never get to that point where things were getting better? [DHT01, 938-956]

In contrast, the DHTs reported that many discharge letters from secondary care regarding patients with periodontitis can often be very informative, containing details of recommended further treatment and a suggested maintenance plan. The inconsistent standard of discharge

letters was considered poor practice and unhelpful to the GDP, DHT, and patient. It was felt that the clinical teaching staff, who supervise discharge letters, are so varied in terms of their education and standards of practice, that the use of a template discharge letter would improve the situation.

> That's when you get the problem isn't it, with all different people [GDPs clinically teaching] in [the dental hospital] from outside [primary care]. But maybe's if they had a standard thing they've got to, stick to, when they're doing their discharge letters, that might make a difference, mightn't it? If they've got like a ticky [box form]. That would definitely be a good start I think if we could do something like that, it would make a big difference I think. [DHT01, 1050-1084]

Communication between the referring GDP and the dental hospital was considered particularly difficult as the GDP cannot easily speak with the hospital consultant to gain clarification or obtain more information.

> I think it's hard to get any information out of the dental hospital sometimes, you can't just even just pick up the phone and ring 'cos you get through to your switch board…you don't know whereabouts you are, who to speak to? Nobody rings you back. [DHT04, 1086-1112]

The only way to discuss the patient's treatment is via letters, which would take time and is not practical, leaving the GDP to accept whatever is in the discharge letter, however brief.

- *Misuse of dental services*

Direct access to DHTs by patients and members of the public was approved by GDC in 2013. It meant that a patient could see the DHT without having to first see a GDP. Some DHT participants disapproved of this and saw it as an invitation for the public to attend for a 'cosmetic' scale and polish, a quick fix for someone to improve their smile whilst they neglect their periodontitis or additional restorative needs. It is unclear whether the description below is a description of an actual event or a hypothetical one, but the DHT is clearly against DHT services being used for cosmetic outcomes.

> I won't see anyone, off the street. I've refused to sign anything that will say I will see anyone via direct access, 'cos I think to be perfectly truthful it's a waste of time…they [the patient] can come off the street, and, haven't been to a dental practice for 10 years, but they're going to a wedding so "can you just, get rid of the stain around here?" And you look and you think, "Not really. Yeah we could get rid of the stain, but, your teeth are wafting in the breeze"[loose due to bone loss as a result of advanced periodontitis]. You need, further treatment… I think you'd spend, an awful lot of time, and I know the practice wouldn't give you an awful lot of time.

> They'd give you your routine 15 minutes, and, you'd spend a half an hour, trying to convince this patient that we need to refer you…my practice …they'd be very much a case of, you've got your 15 minutes, they've come for a scale and polish, do your scale and polish, and, I couldn't do that if I know that's not right. [DHT03, 587-687]

A reference to some patients wanting just a 'clean and polish' when they have periodontitis was made by other DHT participants. This was clearly a cause for frustration due to the patient not recognising their condition or engaging with the DHT in an appropriate way. It once again seemed to reflect that the DHT wants to be recognised as a health practitioner, as opposed to a passive 'cleaner of teeth'.

> But you feel like it's your duty of care don't you? Personally you want to help people, as best as you can. A lot of my patients on Mondays and Fridays, just want polishes, they've got rampant perio [periodontitis] but they don't care that their teeth are wafting in the wind [loose due to advanced periodontitis], and they're not going to have any teeth to clean in 10 years' time, [but] they just want a polish. So they don't, they don't get it, do they? [DHT01, 706-719]

The DHTs' frustration continues with accounts of the GDP referring their patients for a 'clean and polish' also. It is unclear whether the GDP has adopted the lay terminology from his patient or the patient is using the same language as the GDP, but from the perspective of the DHT it appears to trivialise the DHT and the work that they do, making communication between the DHT and patient harder.

> But he calls it a clean and polish as well though, so they all come through to see me and say like, they want a, they want a clean. They don't know what a deep scale is or anything, they just want their teeth cleaned. And then you've got all that to explain to them, that, you're not there necessarily to clean their teeth, you're there to clean up [treat] the gums [periodontitis] and…Yeah, it's, but it's hard work. [DHT01, 1646-1656]

Unless seen by direct access, the patient is seen by both a GDP and a DHT for the diagnosis and treatment of their periodontitis, and for periodontal maintenance and ongoing care. Typically, the patient is placed on a three-month recall following the initial periodontal therapy during which a regular assessment of the response to treatment is carried out by both the GDP and DHT, so that future treatment is tailored to the patient's needs. This shared care of the patient can cause conflict, as seen in the following scenario when a vital assessment is missed.

> …sometimes you'll do the initial course of perio [periodontal treatment], but then like you said, the three month one goes back with the dentist because a check-up has to be included in it…if they [the patient] don't see me, they'll [pocket probing depths] not get done [won't be recorded]. [DHT04, 1430-1452]

Oral health education and OHI is important, not only in the treatment and success of periodontal treatment, but for overall oral and dental health. Although education is seen as being the responsibility of all dental professionals, it is recognised as central to the role of the DHT in the treatment and prevention of disease. The presence of a flat screen television in waiting areas is common in dental practices but the fact that they are often used to display/sell cosmetic treatments, such as tooth whitening or invisible adult orthodontic treatment (when they could be better used to educate patients) was another example of the misuse of dental services, according to the DHT participants.

> I mean, an awful lot of practices these days [could] have, you know, lots of oral health messages going across their big flat screens, but they don't have, it's more geared to, what the practice can offer you, to make this better, or your smile better or whatever…Yes but it's never ever educational [it's about sales and cosmetic treatments], I mean even the blurb about what the hygienist can do for you, is all to do with the cosmetic look, it's not to do with how it [periodontitis], if going undetected, could do this this this and this, so, it's an area there, it's up, I mean every patient sits and looks at it. [If] practices were informing, [it] could pre-empt a conversation when they come through, would be really useful because they sit and look at it. [DHT03, 1703-1734]

The flat screen television, if used effectively, could inform and improve discussion between the DHT and patient, validating the importance of the DHT and good oral hygiene (and good oral health), however, the sales of private and cosmetic treatments were suggested to take priority and patients were negatively influenced: "they [patients] get brainwashed" [DHT01, 1736].

- *Unrealistic expectations*

Managing patient expectations is an important part of shared decision making in treatment planning. This is particularly true for periodontal management, which requires a long term (life-long) management strategy due to the chronic inflammatory nature of the disease. In addition, often the outcomes of successful periodontal treatment are problematic, for example, tooth sensitivity and gingival recession. The DHT participants gave accounts of patients who wanted (or expected) a quick fix to their periodontitis, with similarities made to having a tooth repaired (which may take one visit).

> I think as well, patients struggle with the fact that, you, know, if they've fractured this upper 1 [upper first incisor tooth] and they go, "I've had the composite build up done [tooth repaired], right, I'm fine I'm off, I've done", and they don't, I don't think they realise that, perio [periodontal management] is, a long haul thing, it's not something that we're going to be able to fix [quickly]. [DHT03, 792-798]

The DHT participants felt that the patients often did not seem to appreciate the commitment necessary to manage their periodontitis. This could ultimately lead to future disappointment (in terms of suboptimal treatment response) and a potential reduction in the motivation necessary to continue to attend multiple appointments (for, what can be for some, uncomfortable or even painful treatment) and carry out the daily oral hygiene procedures necessary to reduce the bacterial challenge that drives periodontal inflammation.

Consistent with the patient accounts previously reported in this chapter, DHTs gave descriptions of scenarios in which the patient mistakenly thought they were being referred for NHS periodontal treatment, when they were actually charged privately for it. This was considered a difficult situation to manage and one that could (and should) have been avoided.

> Well that's, that's, I mean I, I would imagine, it's then up to you to explain to the patient [that the DHT appointment is private] and that's not our job. That's the dentist's job to explain, that should have already been already explained. By the time you've argued that, half the time's gone. [DHT02, 1469-1499]

The DHT participants continually referred to their short appointment times and the difficulty this creates to completing the prescribed treatment. This created a tense, pressured environment in which to work, and one which was worsened by having to have conversations that were not considered to be a legitimate part of their role: "…that's not our job" [DHT02, above]. In the account below, a DHT describes, with a sense of disbelief, the unrealistic expectations of a GDP who had written a prescription for extensive treatment to be carried out in one 15 minute appointment. This ultimately meant that the DHT would have to have an awkward conversation with the patient regarding the need for more time/appointments which will cost more money, a conversation which the GDP could, and should, have had when the treatment was initially discussed.

> In the NHS practice I work at on a Monday and Friday, so everyone, most of the patients that I practice come back every three months, they do need to come back to be fair. But then it's like yesterday I got a referral, 'cos one of the dentists doesn't refer to me very often, but she's done this a couple of times over the last few weeks where I'm, I get 15 minutes with the patients… she's asking for PPD's [pocket probing depths], half mouth RSI with local anaesthetic, and OHI, in 15 minutes? I'm,

> obviously I can't do it, it's not possible for us to do it, but I don't know, she doesn't refer very often, she tends to treat most of her patients herself but obviously the ones she can't treat, or doesn't feel like she's got time to treat, she sends my way, but I don't know what she thinks I'm going to do in 15 minutes. [DHT01, 473-497]

This particular scenario was even more surprising to the DHT since the referring GDP normally carried out periodontal treatment as opposed to referring to the DHT, so they should have known how long the appointment needed to be.

One of the DHT participants commented that the way the dental undergraduate periodontal teaching is organised contributes to unrealistic expectations. They described how periodontal treatment should be taught separately, however it is frequently taught as part of restorative care (which typically includes the disciplines of periodontics, endodontics and prosthodontics as part of overall restorative care). This is an issue because it involves treating a chronic disease (periodontitis) requiring a different approach, alongside the treatment of other diseases or conditions (for example, caries, missing teeth, tooth surface loss) which may be able to be managed in one or a few visits.

> And I often think that's a problem, with the way dental students are taught and the way hygienist therapists are taught. Because they're, although there's better teaching [for] oral hygiene and things like that nowadays, but they're main focus is, on, repairing… and not actually looking at [periodontitis], I know we're going about this holistic approach and everything but they still tend to focus down that, "need x-amount of fillings, and yeah, we'll give them a quick scale". It's easy to, it may be easy to do, or maybe it's the, the teaching isn't right. [DHT03, 820-843]

NHS dental services in primary care are partially restricted, so some treatments are not available. This may create a disparity in expectations between the patient and provider. In the scenario below, the disparity is between the GDP and DHT. Here, the DHT offers a suggestion to improve patient education which is rejected by the GDP because it is the 'NHS' and the GDP does not want to raise patient expectations.

> When I first started working at an NHS place, I've never had 15 minute appointments before so I really panicked, so I spent ages doing my OHI and educational stuff, that's more important to me than anything else. So I thought if I do that first, if they come in every three months, I would concentrate on OHI [oral hygiene instruction] initially and every time they come in we'll, do that bit extra. But I couldn't, do that at that practice 'cos the patients all want, polishes. But before I started, I was thinking, how can I [work under such time constraints]? 'Cos I knew that, my friend used to work there, so I knew what it was going to be like. So I'd asked the owner if I could, do some-, 'cos I've got my own information sheets that I devised years ago, so I was like,

> "Oh, can I print these out and just give them to the patients when they come in for their appointment", and they can be reading through them in the waiting room then at least they've got the information that I want to give them, in written form. And I was dead pleased about it, he just poo-poo'd [rejected] it and was basically, "It's an NHS practice, and the patients don't deserve to have this, this kind of information". [DHT01, 1629-1638]

As the DHT had been used to working in private practice (presumably with longer appointments) then it is understandable that they might have to make reasonable adjustment to fit in with the NHS system (and shorter appointments); and it is unclear, but maybe the GDP had concerns over the cost of printing. Notwithstanding, the cost of dental treatment is a significant concern for patients (as seen previously, PI02), not only in terms of affordability but also whether the treatment is seen as value for money. Here a DHT explains that patients have no idea how expensive it is to provide dental treatment and their lack of perspective regarding cost can mean that they expect to get more than they get.

> I think money is a very big, factor within, how the system works. And I think an awful lot of patient's expectation is, they go to the doctors and they don't pay anything apart from their prescription charge or whatever, they might have to do as far as that goes, but their point of source of treatment, there is no monetary exchange. Whereas when you come to a dental practice, they feel as though, "Well, I'm paying for it", and although the payment is, is a minimal charge and when you, when you look at how, much dental treatment does actually cost, the patient doesn't see it that way. And I think they can sometimes, their expectations are greater sometimes, the ones that do come, expect an awful lot more, than what they actually get on occasions. [DHT03, 865-882]

The DHT participants agreed that they would rather not have to discuss money with the patient. They felt that if the initial discussion regarding what treatment was needed, how long it would take and how much it would cost, was the responsibility of the referring GDP; and that estimated duration and cost of treatment should be realistic.

7.2.5 The results of the feasibility and acceptability of the interventions and indirect referral of the patient with suspected diabetes from the GDP to the GP mapped to NPT

The results of the feasibility and acceptability of the interventions are presented according to the intervention and in summary tables according to the individual interview or focus group mapped to NPT constructs. Table 7.4 shows the results of HCP interviews and focus group and Table 7.5 shows the results of patient interviews.

Table 7.4 Results of healthcare professional interviews and focus group (n=3) mapped to NPT constructs

NPT constructs	DSN practitioner in medical practice 2 (interview)	HCA in medical practice 1 (interview)	Medical practice 1: focus group (n=5)
Coherence	Intervention different from anything she does. The practice seemed to understand what was involved, but it was only the nurse who delivered the intervention, as she provided the diabetes reviews. She seemed to understand what she had to do and valued the intervention, but was asking about oral hygiene (i.e. adhering to the Arden's template wording, as opposed to asking when was the last time the patient saw a GDP) and did not always hand out the leaflet.	Intervention different from anything she does. The practice understood what was involved, (diabetes lead GP asked her to be involved: when taking bloods to ask about GDP, give leaflet and offer referral to DHT). She only handed 2 leaflets out as does this only when patients asked questions.	Wouldn't routinely think about asking about whether someone has a GDP. However, they thought it was a great idea though and the nurse started informing the patients from the first meeting we had (development workshop). Thought they understood, but I think GPs focused on trying to get the DHT (SMB) fully booked, rather than informing the patient – the referral to DHT seemed to overshadow informing the patient about the links between diabetes and periodontitis. Maybe this was because they expected to have more uptake for the referral and felt 'bad' about the low uptake.
Cognitive participation	Nurse initiated the pilot and felt it was a legitimate part of her role. She is keen to continue (photocopied leaflet for future use).	Legitimate part of role (has been involved with a trial before).	Were keen to get started and everyone was on board, including GPs, nurses and HCAs.
Collective Action	Fits in with other work (diabetes reviews). She is confident with her skills and her organisation enables the activity. She says this is much easier than discussing erectile dysfunction, for example.	Fits in with 'twitter' (chatting to patient to distract them from taking blood). Happy with skills – happy to signpost.	It fitted in for the HCA and nurse, but not so much for GPs (who were focussing on medicine reviews, so they found it hard to fit it in and it made the consultation run over time). There were no skill set issues.
Reflexive monitoring	It seems to have fitted in with the system, but that is may be because it is on the Ardens template. Communally, the practice has signed up to the new template to help with diabetes screening and pick up on problems. She has not followed my intervention by the letter but is doing a version of it and intends to continue.	Oral health is important.	They were keen in beginning, but were surprised at how many patients already had a GDP, so do not think it is as useful to the practice as they first thought. They seemed to overlook the importance of informing patients, but focussed more on identifying those without a GDP and referring them to the DHT. The GPs sometimes struggled to remember to ask the patient and were unable to add to template, so relied on a pop up message on patient record to remind them. I wanted to interview patients – some who accepted referral and some who didn't. There were 2 who didn't go to GDP but were too scared to see me and therefore wouldn't be interviewed either.

NPT: Normalisation Process theory; HCA; Healthcare Assistant; GDP: General Dental Practitioner; DHT: Dental Hygienist/therapist; DH: Dental Hospital.

Table 7.5 Results of patient interviews (n=3) mapped to NPT constructs

NPT constructs	Patient with diabetes (interview PI001)	Patient with diabetes (interview PI002)	Patient with periodontitis (interview PI003)
Coherence	Found intervention interesting and valued having the opportunity to see DHT for oral health risk assessment as it was 30 years since he last went to the GDP.	Makes sense to be informed as diabetes affects everything, so why not gums.	Pt was shocked. GDP seemed harsh in language and approach which upset the patient. GDP did not explain rational/links. She acted on it because she was frightened that she had a disease which was affecting her gums and GDP had told her she would lose all her teeth in next 10-15 years.
Collective Action	Relieved to find out there were fewer problems than he thought he had and intends to go to the GDP.	Keen to speak with DHT (but maybe wanted to vent off or to help out with some research) and help out the HCA who was recruiting.	The way the GDP introduced the concept of suspecting diabetes was blunt with frequent use of the word 'concerned' saying, 'there's something going on'. They did not attempt to contact the GP or assist communication that they expected the patient to have on her own, making it difficult for her, especially as she was not fully informed either. Although there was no mention of the referral being not the role of the GDP, it could have been done in a more informed and sensitive way.
Cognitive Participation	Fits in with his diabetes reviews – nice to know people are linking oral health with diabetes – feels looked after.	Fits in with diabetes and general care at medical primary care.	The intervention was disruptive to the patient who felt shocked and it did not seem to be integrated/explained in a great way. Whether there was a problem with the skill of the GDP is unclear, but the way it was delivered could be improved.
Reflexive Monitoring	Thinks it should be rolled out to other practices.	It is useful to know, but he is unhappy with GDP/DHT so won't go (isn't value for money as teeth continue to get loose).	The referral was useful to rule diabetes out and fortunately for the patient it prompted an 'Over 40' check-up, which came back all clear. The GDP also referred her to the dental hospital and that has been useful too. Despite this, the patient is considering changing GDPs and has concerns over her increased periodontal treatment needs being a way for the GDP to make money. It appears that although the GDP is NHS, the periodontal treatment is done by the DHT which is private, but this is not explained. The way that the GDP communicates is not good and it showed little awareness of the impact of telling someone they are at risk of having diabetes.

NPT: Normalisation Process theory; HCA; Healthcare Assistant; GDP: General Dental Practitioner; DHT: Dental Hygienist/therapist; DH: Dental Hospital.

7.3 Discussion

Oral health interventions to enable (indirect) referral for early diagnosis and treatment of periodontitis in patients with diabetes were piloted and evaluated for experienced feasibility and acceptability in a primary medical care setting. The 'Discuss and refer to a GDP' intervention was piloted by a DSN who led the diabetes review clinics in her medical practice. Whilst there appeared to be difficulties adding a prompt question to the diabetes review template, the fact that the practice had recently adopted a new diabetes template (Ardens template) which happened to include an oral care section, proved fortuitous. The presence of the oral care section circumvented any issues that the practice might have in terms of adding questions on oral health to a pre-existing template which did not contain such questions. This section of the template served as a reminder, and provided a formal time and space for the intervention which helped to validate and normalise it. The oral care section was on its seventh version (Appendix 12), being first included on the template after a request from an Ardens user (a medical HCP). The current version contains fields relating to gums, mouth, teeth, oral hygiene, notes, advice given on oral health and gum care, advice to inform GDP of diabetes and to have annual check-ups; and there is an option to print a leaflet that was produced by the Scottish Dental Clinical Effectiveness Programme (SDCEP) explaining the links between diabetes and periodontitis (Appendix 13). Ardens is the first diabetes template to come to attention that includes an oral care section. The DSN reported that the patients were accepting of the intervention and if they wanted more information, she could provide them with a leaflet.

- *Key message for researchers regarding the 'Discuss and refer to a GDP' intervention*
The DSN and the other staff at this practice were enthusiastic about the intervention in the development workshops and were keen to be involved in the pilot, however initiating the pilot took some time. One of the reasons for the delay was that the practice had just appointed the NP to lead the diabetes clinic and she had to undergo specialist diabetes training (to become a DSN). Furthermore, the practice decided to change to Ardens templates with the aim to improve patient care. As Ardens templates are used in over 700 practices in the UK (and growing in popularity), future research could involve also running a Read Code report to offer a formal evaluation of the intervention. Also an RCT of the Ardens template would help to explore the impact that the oral care section has on intervention fidelity.

The 'Discuss and refer to a DHT team member' was piloted by an HCA, PN and two GPs working in a medical practice which did not have a specific diabetes review clinic. In this

practice, the patients would see the HCA first to have bloods taken and would then make an appointment to see the PN, or the GP if they needed a medication review. The HCA and PN delivered the intervention with ease and it was not disruptive to their appointment schedules. The HCA stated that it fitted in with her 'twitter' which was a dialogue that was aimed to distract the patient from the unpleasantness of having bloods taken. She also stated that she was mindful for the conversation not to become too 'educational', as this was the role of the PN. Such a defined construct of role has been described in the literature and is associated with the negotiation of 'task work' (what work must be done) and 'task roles' (who should do what work), both of which are important in team dynamics and inter-professional collaboration (Forsyth 2013, MacNaughton *et al.* 2013). Furthermore, it is unclear whether the HCA's perception of role and professional boundaries was learned by tacit or explicit means. For the PN, the intervention seemed to dovetail with discussions relating to patient self-management and aligned with her educational role, both of which are central to a nurse's role in diabetes management (Siminerio *et al.* 2007). The GPs, however, found that the intervention felt intrusive in their consultations (medicine reviews) and disrupted their schedule. The need for longer appointments for the management of complex chronic care conditions is well documented (Larme and Pugh 2001). It has also been suggested that GPs tend to naturally align to a role of prescriber/referrer (Siminerio *et al.* 2007), which may explain why the GPs seemed to focus more on the referral to a DHT, than discussion with the patient. Whilst there was little uptake of the DHT oral health assessment by patients during this short pilot, this may have been indicative of the relatively affluent locality of the practice, as most patients already had a GDP with whom they were in regular attendance.

The medical practice staff were consistently enthusiastic regarding the addition of a DHT to their diabetes team. Collaboration has been shown to work well if the professionals already have a relationship with each other (Holzinger *et al.* 2016, Lublóy *et al.* 2016) which must be considered in the context of this pilot and evaluation work as the DHT was the researcher (SMB). In addition, unwanted dialogue relating to dental problems between the medical staff and the patient would be circumvented with such a referral. The inclusion of a DHT into a diabetes team and 'one stop shop' model as described in the WDI case study in Chapter 3, is an exemplar of truly inter-professional and inter-disciplinary diabetes care (Pumerantz *et al.* 2017). Notwithstanding, there were initial concerns as to a lack of available space for the oral health assessments. This was solved by offering the DHT appointments at times when the surgery was normally closed to patients, and when the administration staff caught up with paperwork and phone calls. This meant that there were no other clinical staff present and the

treatment room was available which was fitted with a couch and movable lamp making the oral health assessment easier. Whether the scheduling of the DHT session was a barrier for some patients is unclear, but unavailability of space is a feature in primary care for both medical and dental practices, as there is often a limit to how practices can be adapted or extended to accommodate growth for more staff and treatment rooms. For future research, this intervention could be adapted to refer to a DHT in a nearby practice who could see patients under direct access, but the feasibility of such a referral and availability of such services would have to be evaluated.

- Key message for researchers regarding the 'Discuss and refer to a DHT team member' intervention

These results suggest that the implementation of 'Discuss and refer to a DHT team member' has been interpreted and delivered in subtly different ways by the HCA, PN and GP; and if the overall task (or overall goal) was to deliver this intervention, their task work (what was done) was perceived relative to their task role (professional role) (Forsyth 2013), which is important to note in any future implementation research. It is not clear exactly how many patients the intervention was delivered to during the pilot, and future studies would need to formally record this (something that was not possible as part of the pilot) to accurately assess patient uptake of the intervention. It would also be beneficial in future research to formally evaluate the intervention in a range of different locations, with varying levels of socioeconomic status and deprivation, as it is possible that these aspects could also affect uptake of the referral to the DHT. Furthermore, this intervention could be adapted to refer to a DHT in a nearby practice who could see patients under direct access, but the feasibility of such a referral and availability of such services would have to be evaluated.

Indirect referral, or advising the patient to consult with another professional, was discussed at length in the workshops in Chapter 6. Both the medical and dental professionals justified their preference for this method of communication as it reduced administrative burden and empowered the patient, thus negating the need for direct communication, for example, via a referral letter, which would then require additional work to be undertaken by the practice staff to contact the patient and make an appointment. However, the account given by the patient who was advised by her GDP to go to her GP for a diabetes assessment would suggest that the experience was not empowering; rather it was described as shocking and worrying. This patient's distress may have been alleviated if there had been explanations and reassurance from the GDP or the GP; however this was not the case. It appeared that the GDP was

concerned about the patient's periodontitis and the (direct) referral to the dental hospital for a consultant opinion was appropriate, albeit abrasive. The indirect referral to the GP inadvertently placed the patient in the position of having to explain why she wanted a blood test without having been previously informed of the links between diabetes and periodontitis. This created an awkward situation for the patient. Furthermore, the GP was confronted with, indirectly, a request from a GDP (who was not known to the GP) to carry out blood tests to assess for presence of diabetes in a patient whom the GP was confident did not have diabetes, and performing such blood tests was against their judgement. This account describes some of the known barriers which inhibit collaboration and lead to miscommunication between professionals, such as being seen to be telling another professional how to do their job, to be told that they have a gap in knowledge or to be challenged over their judgement (Larme and Pugh 2001). Clearly, although in workshops (Chapter 6), both GPs and GDPs had indicated that they would favour an indirect referral via the patient, this particular case clearly highlights how ineffective, and potentially damaging, such an approach can be. Fortunately for the patient caught in the centre of this situation, the patient was eventually reassured by the nurse who took her blood, and the results of the diabetes assessment and 'Over 40' health check were both good, with the GP's conviction that the patient did not have diabetes being proven correct. The reassuring approach of the nurse is supported by the findings of the US Diabetes Attitudes Wishes and Needs (DAWN) study, which identified that nurses agreed that an important part of their role is to provide patients with security and hope, and that they felt that they are better than physicians in doing so (Siminerio *et al.* 2007).

The NICE PH38 guidelines, which were discussed at length in the workshops (Chapter 6), recommended a diabetes risk assessment (Appendix 2) in the dental practice via a questionnaire (supporting guidance presented in Appendix 14) prior to a written referral via a GP template letter (Appendix 3). The appropriateness of this assessment and subsequent referral was questioned by some of the patient workshop participants. In the scenario described above, had a risk assessment been carried out on the patient in question at the dental practice, the risk score would have been low, negating the reason for a referral and reassuring the GDP and patient that the chances of an underlying health condition (i.e. diabetes) affecting the periodontitis was minimal. If the risk score was higher and a referral was indicated, the template referral letter could have perhaps been sent in advance and a duplicate provided by the dental practice for the patient to take with her to give to the GP when she attended for her appointment. This letter would have supported the GDP's decision to refer,

would have provided a substitute for a formal dictated referral letter, and also would have informed the GP of the evidence linking diabetes and periodontitis.

The periodontal management described by two patients and the DHT participants suggests that although access to an NHS GDP may not be an issue in the North East of England, this does not necessarily mean that there is access to periodontal treatment on the NHS. In Chapter 5, the dental survey self-reported findings for the proportion of time spent treating periodontitis found that only 16% was treated on the NHS, whilst 84% was treated by private/Denplan/other. These data would suggest that there may be a problem with accessing periodontal treatment under NHS regulations, however, the results must be interpreted with caution as further research is required to explore this issue in more detail. Notwithstanding, the demarcation between NHS and private dental services does not appear to be clearly understood by patients; and periodontal treatment options and the associated costs need to be clarified by GDPs and fully explained to patients before referring them for treatment with a DHT. Furthermore, the DHT participants expressed a real sense of frustration about how they are expected to provide periodontal treatment with inadequate time and manage unrealistic expectations of patients (who just want a quick fix), coupled with GDPs who don't actively emphasise the importance of the DHT and the work they do to patients. Perhaps the fact that the GDP is frequently required to pay a referral charge to send their patient for periodontal treatment, a charge which is increased in corporate dental practices, means that periodontal treatment is, in essence, priced out of the NHS. If this is the case, GDPs need to be prepared to enter into discussions with their patients with periodontitis to clearly explain that they cannot (or will not) offer periodontal treatment under the NHS. There appear to be many barriers to effective periodontitis prevention, treatment and maintenance which have the potential to impact negatively on the periodontal outcomes for any patient, not the least for patients with diabetes. It is unclear how this will effect inter-professional collaboration, but it would seem that changes are needed in primary care dentistry which may include embedding DHTs into medical practices. Perhaps this would be the only way to actually incorporate periodontal management into diabetes care pathways.

7.3.1 Strengths and weaknesses

The inclusion of a DHT member to a primary care diabetes team and the integration of oral health interventions into routine diabetes management are novel and have not been reported in the diabetes and periodontitis literature before. Data were included from a full range of medical practice staff, key dental staff (DHTs) and patients.

Future research would aim to increase the number of practices and vary the socioeconomic status and deprivation as only two medical practices, which were both in the North East of England, were included in this pilot work. The medical professional participants had been involved with the previous intervention development work and were known to the researcher (SMB). Thus, it is acknowledged that this could be a possible enabler when evaluating their willingness to participate, fidelity to the intervention and continued engagement when dealing with constraints (like time pressure). Furthermore, it was not possible to interview patients who were offered the 'Discuss and refer to a GDP' intervention or those were offered a referral to a DHT team member but refused. Also the number of patients who the interventions were offered to was not explicitly recorded. Future research would also aim to carry out focus groups with GDPs, to see how their opinions compared to those of the DHTs, regarding the management of periodontitis.

7.4 Conclusion

The aim of this study was to pilot trial and evaluate for experienced feasibility and acceptability 'Discuss and refer to a GDP' and 'Discuss and refer to a DHT team member'. Both interventions were experienced as feasible and acceptable for nurse providers which is in keeping with the results of the survey in Chapter 4. Determinants for delivery of the interventions were aligning the job task to the job role; and the inclusion of an oral care section on a diabetes template, which provided the formal 'time and space' for the intervention. Inter-professional collaboration was perhaps aided by the fact that the medical professionals delivering 'Discuss and refer to a DHT team member' and the DHT (SMB) were already known to each other and had already successfully worked together to develop the interventions (Chapter 6).

A future feasibility study of the inclusion of a DHT into a diabetes team could use stratified sampling to vary the socioeconomic and deprivation index of sites. It may also incorporate a hub and spoke model of referral with the hub being central and located at a practice with space available at a time when the practice was open to patients. In addition, instead of the DHT signposting to an NHS practice (which may or may not offer NHS periodontal treatment), the referral could be to a specified DHT seeing patients (under NHS arrangements) via direct access or a specified GDP who is known to offer treatment of periodontitis on the NHS.

The indirect referral of a patient with suspected diabetes by a GDP to a GP may have been improved if the GDP had carried out a risk assessment (via a validated questionnaire) and

supported the referral by giving the patient a copy to bring to the appointment and sending a copy referral letter to the GP. Despite the fact that both professional groups had previously indicated a preference for this form of indirect referral, it clearly did not work in this case (albeit a single patient case), and the issues raised would need to be assessed in future research also.

Chapter 8

Chapter 8: Discussion

The thesis has presented four studies carried out over three phases of research. Phase one explored behavioural and organisational correlates of primary care medical and dental professional clinical behaviours in the context of diabetes and periodontitis (Chapters 4 and 5). Phase two designed and developed oral health interventions to be delivered in a primary medical care context, whilst also exploring inter-professional working between medical and dental professionals to improve early identification and treatment of diabetes and periodontitis (Chapter 6). Phase three piloted and evaluated two oral health interventions in primary medical care for feasibility and acceptance (Chapter 7). This final chapter discusses key findings, alongside strengths and weaknesses, from each of the studies. It explores implications for clinical care; and concludes with the impact of the research to date and a proposal for future research.

8.1 Overview

As outlined in Chapter 2, diabetes prevalence is increasing exponentially and is frequently referred to as a global epidemic (Diabetes.co.uk 2018a). In the 2011 United Nations Summit meeting, all member states passed the UN Resolution on non-communicable diseases (NCD) including diabetes, to keep them high on the international agenda (World Health Organisation 2011a). In 2013, WHO adopted the goal to reduce premature mortality from NCDs by 25% and set nine voluntary targets for 2025, including a 0% increase in diabetes prevalence (World Health Organisation 2018b).

Evidence linking diabetes with periodontitis began emerging in the literature from the early 1990s (Löe 1993) and research has continued to explore the mechanisms that connect the diseases and the clinical implications of periodontal treatment on diabetes outcomes, such as improved glycaemic control (Simpson *et al.* 2010, Simpson *et al.* 2015). Despite publication of multiple meta-analyses and two Cochrane reviews on the impact of periodontal treatment on improving glycaemic control, the research connecting the diseases has not translated into improved diabetes management or joint working between medicine and dentistry.

This may be partially due to the separation of dentistry from medicine which, in the case of Britain, occurred in the early to mid-20th century. From this time, medicine and dentistry emerged as independent regulated professions and dental health was the jurisdiction of GDPs and quite separate, although closely related, to general health (Davis 1980). The organisational division has been described from a sociological perspective as essentially

'separating the mouth from the body' (Nettleton 1988) and this creates distinct challenges such as organisational barriers that may hinder the transfer of information and education from medical sources to help the patient to access dental assessment, monitoring and treatment (Bissett *et al.* 2013).

The aim of the three phases of this research was to develop oral health interventions to be delivered by medical professionals that would inform people with diabetes about their increased susceptibility to periodontitis; and alert them to the potential benefits of periodontal treatment including the reduction of HbA1c levels; thus, providing them with the ability to make informed choices regarding their diabetes and periodontal management.

8.2 Key findings

8.2.1 The survey work

Previous research suggested that medical professionals and people with diabetes were unaware of the evidence linking diabetes and periodontitis (Bissett *et al.* 2013) and whilst knowledge alone is not guaranteed to translate into clinical practice (Larme and Pugh 2001), it is a necessary component of behaviour change. A survey of medical and dental professionals was undertaken to further explore and contextualise their current and future adherence to best practice recommendations and buy-in to inter-professional diabetes and periodontal management; and ascertain, using theoretically informed questionnaires, factors that would inform intervention design.

The self-reported survey of primary care medical professionals in the NENC and SWP CRN regions (Chapter 4) found that there was little to no *informing* of patients about the links between diabetes and periodontitis or *suggesting* that patients go for a dental check-up currently being conducted. Knowledge was clearly a factor as the randomisation of background information was a statistically significant predictor of the self-reported past behaviour for informing, used as a proxy for future behaviour. In addition, the data from the qualitative free text fields in the surveys described a lack of awareness of the evidence and some defensiveness surrounding this knowledge gap, which has been previously reported in the literature (Bissett *et al.* 2013, McDonald *et al.* 2012). Despite the HCPs clearly indicating that both behaviours were not part of their normal practice (NPT, differentiation), the respondents saw potential in them (NPT, internalisation) and believed that they aligned with their professional role (NPT, legitimation). Furthermore, nurses' scores indicated significantly higher levels of self-efficacy and outcome expectations for informing than GPs; and

significantly higher intention (SCT, proximal goals) than HCAs. The reason for this may be that education and health promotion are integrated into the nurse's role and therefore part of everyday work for nurses (Peimani *et al.* 2010, Siminerio *et al.* 2007).

- *Key message for medical professionals regarding medical professional survey findings*
The results of the survey indicated that HCPs, particularly nurses, have an important role in *informing* patients with diabetes about the links between diabetes and periodontitis and *suggesting* they go for a dental check-up at diabetes diagnosis or review appointments, particularly for patients who do not attend the GDP. Regression analyses found self-efficacy to be a predictor for *suggesting.* As it would make sense to *inform* patients about the links prior to *suggesting*, an intervention to increase the uptake of *suggesting* and *informing* should focus on self-efficacy, and should aim to address issues of clinical priorities and 'being set up' for the behaviours (such as having a computer prompt and photocopied patient information).

The self-report survey of primary care dental professionals (Chapter 5) aimed to assess adherence to three best practice recommendations in the context of diabetes and periodontitis. The results suggested that overall, a patient with periodontitis and poorly controlled diabetes is likely to be *informed* about the links between the diseases and their clinician will *consider* the impact of the subsequent periodontal treatment on their glycaemic control. However, the quantitative and qualitative findings for *contacting* the patient's GP clearly showed problems with this behaviour which were consistent across all dental professional groups, with low levels of past behaviour reported. According to self-reports, this behaviour would appear more likely to be carried out by a specialist than a DHT or GDP; however, specialist's intentions to contact the patient's GP in the future remained low, alongside those of DHTs and GDPs.

All professional groups scored communal understanding lower than individual understanding for *contacting*, suggesting that whilst individuals may understand how *contacting* the patient's GP affects their work, they do not perceive there to be a shared understanding of the purpose of this amongst the staff in their organisation. Furthermore, the qualitative data indicated a need for practice-level discussions on who, when and how to contact the GP, to create a standardised protocol. Despite the fact that the GDC clearly states in their Scope of Practice document (https://www.gdc-uk.org/professionals/standards/st-scope-of-practice) that DHTs can refer patients to other HCPs, many DHTs were reluctant to *contact* the GP.

- *Key message for dental professionals regarding dental professional survey findings*

The behaviour *contacting* the patients' GP is problematic for all professional groups, but particularly for DHTs. Intervention modelling for contacting the patient's GP should concentrate on outcome expectations and proximal goals; and, although not a significant predictor, perhaps self-efficacy would help with motivation, as the self-efficacy items that were most likely to affect confidence were that contacting was not considered a priority to the patient or the clinician. NPT responses highlighted the difference between specialists and DHTs for contacting; but confirmed the value placed on the behaviour, suggesting that work on communal specification would increase uptake and could particularly benefit DHTs and GDPs. Whilst DHTs were reluctant to contact the GP the findings would suggest potential buy-in from DHTs, provided they were given training to provide necessary knowledge, skills and confidence.

8.2.2 Oral health intervention development

Iterations of workshops (n=6) were held with patients, and dental and medical professionals to develop oral health interventions in the context of diabetes and periodontitis (Chapter 6). The participants were presented with three oral health intervention vignettes and were asked to comment on perceived feasibility and acceptability of delivery in primary care. The idea for the vignettes arose from an informal presentation (by SMB) of the connection between diabetes and periodontitis given to GPs and nurses in a medical practice in North of England. One of the nurses described an intervention in which the patient would be told about the links between diabetes and periodontitis by the nurse or GP. This first vignette formed the basis for a further two modified vignettes. The first step of the vignette was prompted by insertion of a question into the diabetes electronic template: 'When did you last visit your GDP?' If the patient did not have a GDP, following a brief description of the links, the medical professional could either refer (indirectly signpost) the patient to a GDP for assessment ('Discuss and refer to a GDP'); assess periodontitis risk by asking three questions ('Discuss and assess periodontal risk'); or 'Discuss and refer to a DHT team member' for an oral health risk assessment (Table 6.1).

The qualitative data arising from the workshops were analysed thematically and subsequently mapped to NPT constructs, including coherence (sense-making); cognitive participation (engagement); collective action (practice level participation); and reflexive monitoring (perception of effort/outcome ratio) (May *et al.* 2011) (Table 6.5). As the initial design of the interventions was created by a medical professional (nurse), this may explain why there were very few changes made during the development process. The significant impact of diabetes on

patients and their management was evident from both medical and patient perspectives and the 'Discuss and refer to a GDP' intervention was acceptable to everyone as it was considered simple and non-disruptive. The 'Discuss and assess periodontal risk' intervention was not valued by either medical teams, as it offered no benefit over providing the patient with a leaflet (Appendix 11). Furthermore, there was reluctance to introduce discussion regarding periodontitis risk as the GP would be potentially unequipped to answer questions, interpret symptoms or 'dispose' of the topic during the consultation (May *et al.* 2004). The 'Discuss and refer to a DHT team member' was embraced by one of the medical teams; whilst the other medical team rejected it due to fear of high uptake or even dependence by patients on a service which was actually a small pilot. This highlights the local differences that may exist between practices which is important to note for future intervention development and implementation work.

- *Key message for researchers regarding workshop findings*

Oral health interventions must be simple to deliver and non-disruptive to consultations. The 'Discuss and refer to a GDP' intervention was perceived to be feasible and acceptable to all the participants of the workshops (Table 6.6). Whilst the value 'Discuss and refer to a DHT team member' was acknowledged, local access to NHS dental services may affect delivery (Table 6.7).

Although not an intervention requiring development within this research, the NICE PH38 guidance for the prevention of type 2 diabetes provided a topic for discussion which allowed exploration of inter-professional collaboration in the context of undiagnosed diabetes. Whilst patient participants were uncertain regarding the practicalities and appropriateness of assessing diabetes risk in a dental setting, the dental professionals were enthusiastic especially regarding the template GP referral letter (Appendix 3) as it included notes to the GP regarding the evidence and was validated by two leading organisations (Diabetes UK and NICE). The medical professionals engaged with the guidance (Appendix 14) and stated that they would welcome a referral, but would prefer an indirect referral through the patient as it would reduce administration for them. The indirect referral method was further explored in the evaluation work (Chapter 7).

- *Key message for medical and dental professionals regarding the referral of patients with periodontitis and suspected diabetes*

Dental professionals valued the NICE PH38 template letter as it appeared to offer an informative and practical solution to referring a patient with suspected diabetes. Whilst

medical professionals would welcome such referrals they equate referral letters, in any form, with administrative burden and would therefore prefer an indirect referral.

8.2.3 Pilot trial of interventions for feasibility and acceptability in primary medical care

Two of the oral health interventions were piloted and evaluated for experienced feasibility and acceptance in two primary care medical practices in the North East of England; 'Discuss and refer to a GDP' and 'Discuss and refer to a DHT team member'. Both interventions started with a question: 'When did you last visit your GDP?' and the intention was to insert a cue (this question) into the diabetes template. Whilst neither practice altered their template, one created a pop-up note for patients with diabetes; and the other found that the new template that they recently implemented included an oral care section (Appendix 12), so they did not require an *aide memoire*. The interventions were evaluated by interviews and a focus group discussion, which were then thematically analysed and the data mapped onto the NPT constructs (Tables 7.4 and 7.5). The 'Discuss and refer to a GDP' intervention was delivered by a DSN who reported that the intervention was both feasible to deliver and acceptable to the patients. Since the oral care section existed on the template anyway, she said she would continue to deliver the intervention after the pilot closed.

The 'Discuss and refer to a DHT team member' intervention was piloted by a HCA, PN and two GPs. The medical practice did not have a specific diabetes review clinic and the patients would see the HCA first, followed by the PN for the review. If there was a medication review needed, the patient would make an appointment to see the GP. The intervention was implemented and delivered well by both the HCA and the nurse. The GPs struggled as the intervention seemed out of place in their medication review consultation. Furthermore, despite the expectation that many patients would take up the referral for an oral health risk assessment, very few were referred. It was reported that the majority of patients already had a GDP. Notwithstanding, the data analysis indicated that the HCA, nurse and GPs adjusted their 'task work' according to their 'task role' (Forsyth 2013). The HCA was happy to ask the question, inform (briefly) and signpost to a GDP whilst leaving any education to the PN. The GPs felt the intervention was disruptive to their medication review consultation but were invested in the referral of patients to the DHT.

- Key message for GP practices and researchers regarding the delivery of oral health interventions

Utilising an *aide memoire* helps busy medical professionals remember to carry out oral health interventions, however the use of a diabetes electronic template which contains an oral care

section (Appendix 12) may be an enabler embedding the intervention into routinised diabetes management. Furthermore, the 'task role' of medical professionals should be considered when developing and implementing oral health interventions as the alignment of 'task work' to 'task role' may affect clinicians fidelity.

8.2.4 Indirect referral

Indirect referral, or signposting the patient to another HCP, was discussed at length in the workshops (Chapter 6) and both the medical and dental professionals justified their preference for this method of communication as it reduced administrative burden and empowered the patient, thus negating the need for direct communication. The medical professionals stated that they would welcome an indirect referral of a patient with suspected diabetes from a dental professional; however, they had not experienced such a referral. In Chapter 7, an account was given by a patient who had been advised by her GDP to go to her GP for a diabetes assessment. This account would suggest that, unfortunately, the experience was not empowering for the patient and, although we cannot be certain, it would appear that the GP was not comfortable with the referral. Perhaps if the patient had been given a referral letter to hand to their GP, one similar to the NICE PH38 template letter, which included key evidence explaining the links between the diseases and the reason for the referral, this would have ameliorated the defensive reaction from the GP and prevented the patient from having to try to explain why they had been referred.

- Key message for medical and dental professionals regarding indirect referrals

Whilst indirect referrals may have advantages, such as reducing administrative burden and shifting responsibility onto the patient to take action (empowerment), there may be cases where it is not appropriate as the patient and associated HCP may need more information to be able to understand the reason for the referral.

8.2.5 Access to NHS periodontal treatment

Accounts from two patients and the DHT participants (Chapter 7) suggested that whilst access to an NHS GDP may no longer be an issue (in this region), access to periodontal treatment under NHS arrangements may not be so straightforward. The qualitative data indicated considerable uncertainty on the part of patients regarding whether their periodontal treatment was private or NHS; and if it was NHS, which band the treatment would fall into and, therefore, how much it would cost. In these accounts, the patients would often appear to believe that they were receiving an NHS treatment and would then feel confused when they were asked to pay an additional fee for their periodontal treatment (or DHT appointment).

Whilst it is unknown whether GDPs would concur with or contradict these accounts, the dental survey self-reported findings (Chapter 5) for the proportion of time spent treating periodontitis found that only 16% was treated on the NHS, whilst 84% was treated by private/Denplan/other arrangements. Perhaps the higher percentage of periodontitis being treated outside of the NHS is indicative of the fact that the second band of NHS dental charges is inadequate to cover the cost of periodontal treatment, forcing periodontal management into private provision. Furthermore, if a GDP refers the patient to a DHT for periodontal treatment, there can be a referral cost incurred (in some practices and organisations), which may increase the cost of the treatment further. This referral cost was also raised as a concern by a DHT in the qualitative free text data from the dental survey (Chapter 5).

- *Key message for GDPs regarding periodontal management*

These findings would suggest that dental treatment, specifically periodontal treatment, and the associated charges can be confusing and whilst further research is necessary to explore the extent of this issue, the GDP who carries out the check-up and writes the treatment plan should be mindful that the patient may require clarification.

8.3 Inter-professional working

Problematic communication between dental and medical professionals was evident in all three phases of this research. Accounts were given by GPs of (what they considered to be) inappropriate requests from GDPs with regard to prescribing enquiries about patients; these were considered inappropriate by GPs who felt unqualified or un-indemnified to respond. Dental professionals interpreted non-responses or dismissive responses as the GP being disinterested. These findings were consistent with those reported in previous research, both in the UK (Bissett *et al.* 2013) and also in a qualitative study of interaction between GPs and GDPs in Germany (Holzinger *et al.* 2016). Accounts from both professions were at times defensive and accusatory, in part due to previous miscommunication, which, perhaps, reinforced the preference to communicate through the patient. The medical professionals reported that they preferred to communicate with a GDP through the patient in the case of diabetes and potential periodontitis as they felt it would empower the patient. Whether this truly occurs remains to be investigated further, but results suggest that this interaction has the potential to be extremely problematic for both the patient and the GP, and unworkable. Dental professionals preferred to ask the patient about their glycaemic control rather than contact the GP, despite being aware that there would be, potentially, inaccurate responses. Medical

professionals suggested that patients can easily become overwhelmed with the complex nature of diabetes and its comorbidities, which could lead to confusion with understanding results such as blood glucose or HbA1c levels (Gallacher *et al.* 2013, Nam *et al.* 2011, Vijan *et al.* 2005). Notwithstanding, it is uncertain how an inaccurate self-reported HbA1c result, or an ambiguous report of glycaemic control could impact on the subsequent dental assessment or periodontal management of a patient. If the perceived impact is low, this may encourage the dental professional to continue to rely on potentially inaccurate patient report. On the other hand, if there was evidence to suggest that obtaining accurate data in relation to glycaemic control is valuable to periodontal management, in all likelihood, this would involve multiple communications with the GP (or nurse) to obtain regular updates from diabetes review appointments, and this may be more than could be achieved by the dental professional. Further work is needed to investigate these aspects further.

Referrals from a GDP (or DHT) to a GP via a template GP letter, such as the one validated by DoH (Appendix 1) and NICE (Appendix 3), were discussed in the workshops to determine if they offered dental professionals a viable alternative to indirect referral. As no participants were aware of the guidelines or templates, there was no empirical knowledge regarding their potential value; however, the NICE/Diabetes UK template was considered a good idea, especially as it included notes to the GP regarding the evidence and was validated by two leading organisations. The qualitative data from both the dental survey and workshops indicated that a patient with periodontitis and suspected diabetes would normally be indirectly referred by the GDP or DHT to their GP for blood tests. The negative experience of the patient in Chapter 7 who was indirectly referred to their GP with suspected diabetes puts this method of referral into question, however, there is uncertainty as to whether this is an atypical response, and this would also benefit from further research.

The dental survey (Chapter 5) explored behavioural and organisational correlates against three best practice recommendations. There are a number of documents with clinical guidance and recommendations of best practice that have been published in relation to diabetes and periodontitis by a number of different organisations and professional societies. Examination of their content reveals some duplicated recommendations and some different recommendations (Table 3.1). The majority of the participants in this research (mainly clinicians in medical and dental primary care and patients) were unaware of best practice recommendations in the context of diabetes and periodontitis, which suggests that the authors of the guidance documents are, perhaps, not considering the implementation of the recommendations. Whilst it has been reported that there are too many guidelines (Allen and

Harkins 2005), it is unknown if the multiple recommendations from various sources in this case increases the complexity of implementation for dental clinicians; and research to explore how dental clinicians become aware of and value guidelines, and how they implement them into their daily work, would provide valuable insight. The consensus report and guidelines from the joint workshop on periodontal diseases and diabetes held in Madrid in 2017 were launched at the 2018 EuroPerio conference in Amsterdam (Sanz *et al.* 2018a, Sanz *et al.* 2018b). This report was produced by collaboration between the IDF and the EFP, and was published simultaneously in both a dental journal, the *Journal of Clinical Periodontology*, and a medical journal, *Diabetes Research and Clinical Practice*; which is the first time that such joint dissemination has occurred. Furthermore, in partnership with Colgate, a series of publications have been produced which will be centred on a dedicated website which is intended for launch in late 2018 (European Federation of Periodontology 2018). The website will include recommendation guidelines specially produced for different audiences: dental professionals, medical professionals, researchers, policymakers, patients and the public, and the media. A presentation of the consensus report findings and dental recommendations was given at the EuroPerio conference in 2018. The presenter stated that although the aim was to produce recommendations based on evidence, where this was not possible, expert opinion was sought from the consensus workshop members. The dental recommendations, amongst other things (Table 3.1), suggest that GDPs (in Europe) should offer a free dental check-up to patients at certain times in their lives (such as at certain ages). It is unclear whether health service commissioners or dental clinicians were consulted or involved in the co-design of these recommendations, or whether they are in support of, or plan to, implement such a recommendation, and further research is needed.

- *Key messages for medical and dental professionals and researchers*

The results of this research suggest that nurses are the most suited to implement oral health interventions in medical primary care, such as 'Discuss and refer to a GDP'. Whilst active signposting has been seen to be effective in increasing the number of available GP appointments (Siddiqui *et al.* 2017), it is unclear whether indirect referral (or signposting) will motivate a patient to access dental care, further research would be necessary to explore this; but a direct referral from a nurse, or GP, to a GDP would appear to be inherently problematic. Despite the qualitative data that suggest that dental professionals value inter-professional collaboration, the mechanisms for this remain complex. Discussions relating to communication are littered with negative experiences of communication which clearly hinder negotiation. Difficulties in creating MDTs and collaborative working have been reported in

the literature, especially where the GP is unfamiliar with the other professionals (McDonald *et al.* 2012). Perhaps engagement strategies would help to encourage interaction and engagement between GPs and dental professionals. An example of such engagement could be a GDP or DHT presenting the evidence that links diabetes and periodontitis during a diabetes or practice meeting, as the researcher (SMB) did in Chapter 6. This may provide a platform to discuss preferred methods of communication and referral, from dental professional to GP and nurse and vice versa. Furthermore, if GDPs (and DHTs) offered to directly communicate with a designated pharmacist instead of the GP in patient matters relating to prescribing, this gesture may demonstrate a positive intention and work to build trust that has been shown to enable effective collaboration (McDonald *et al.* 2012).

8.4 Strengths and weaknesses

8.4.1 The survey work

These were the first large scale surveys using implementation theories to explore behavioural and organisational correlates of medical and dental professionals' behaviours in the context of diabetes and periodontitis. The questionnaires assessed multiple behaviours which enabled the identification of problem behaviours, and the qualitative data enabled more focused discussion in the intervention development work. The cross-sectional design of the questionnaires limits ability to say what comes first, behaviour or views about behaviour. Future research could use a prospective survey design which would explore what is necessary to move intention through to action and improve predictability.

The questionnaire was completed by self-report, which although a quick and direct way of gathering data, it is inherently biased by recall bias and social desirability bias, which was taken into account when interpreting the results (Choi and Pak 2005, Sedgwick 2013). Although composed of predominantly closed questions, a free-text comment field was included at the end of both sections. It is noted in the literature that the qualitative data from such fields can be under-analysed (O'Cathain and Thomas 2004); however, the free-text fields in these questionnaires provided context and a rich narrative, particularly in the case of the dental survey behaviour, contacting the patient's GP.

A unique feature of the questionnaire was the combined use of SCT and NPT which gave added value in identifying SCT predictors of the behaviours and exploring descriptive elements of NPT which indicated buy-in to the behaviours and improved the intervention development, pilot and evaluation. Future research that includes both SCT and NPT could look for correlations between SCT constructs and NPT items. For example, the SCT construct

‘outcome expectations’ may reasonably be expected to correlate with NPT items relating to coherence – individual specification, though this would need to be formally evaluated.

The dental survey was recruited via the membership of societies affiliated with periodontology. This was to optimise the response rate; however, the population ratio of professional groups was heavily swayed towards DHTs and under-represented dental professionals who were not specifically interested in periodontology. In addition, the low response from the GDP group was a weakness; and the covariate ‘being on the specialist list’, although associated with past behaviour, must be interpreted with caution, as out of the sample population, there were only 21 on the specialist list compared to 307 who were not. The inclusion of *considering* the impact, whilst a cognition rather than a behaviour, aimed to identify whether the dental clinicians treated their patient’s periodontitis in isolation from their diabetes, which although difficult to validate, was important to consider when developing inter-professional working in the context of diabetes and periodontitis.

8.4.2 Oral health intervention development

Six workshops enabled the perspectives of patients, medical and dental professionals to iteratively develop interventions to be delivered in primary care medical practice and explore inter-professional communication in the context of diabetes and periodontitis. Development of interventions via workshop methods was considered appropriate as it would enable broad discussion of the perceived feasibility and acceptability of the design and creative problem solving. Notwithstanding, recruitment of HCPs (both medical and dental) to the workshops proved challenging, and it was difficult to find people who were interested and available. Thus, the decision was made to recruit HCPs on a practice level and diversification was achieved through delivering two workshops per cohort; inviting a broad range of professional job roles; and many participants brought their experiences of working in different locations into the discussion. The dental workshops were held at the practice during the staff’s lunchbreak and the medical workshops were scheduled at the practice as part of their regular diabetes meeting; with refreshments and remuneration provided.

It is acknowledged that as the researcher who facilitated the workshops and analysed the data, was a DHT (SMB), and, as such, very close to the subject matter, this may have influenced the data collected and the analysis of the results. Notwithstanding, all aspects of the study were discussed with supervisors, the steering group and members of the university progression panel. In addition, the workshops provided a platform for scrutiny and re-assessment of feasibility and acceptance.

8.4.3 Pilot trial and evaluation of oral health interventions for feasibility and acceptability in a medical context

The integration of oral health interventions into primary care diabetes management are novel and has not been reported in the diabetes and periodontitis literature before. In addition, a DHT has not carried out oral health risk assessments in a medical practice previously, as far as the research team are aware. Evaluation data of the interventions were included from a full range of medical practice staff, key dental staff (DHTs) and patients. However, it was not possible to interview patients who were offered the 'Discuss and refer to a GDP' intervention or those were offered a referral to a DHT team member but declined this opportunity.

As only two medical practices were involved with the pilot, future research would aim to increase the recruited number of practices participating, varying the demographic, socioeconomic and deprivation status. In addition, care should be taken with the interpretation of the results as the medical professional participants had been involved with the previous intervention development work and were therefore already known to the researcher (SMB). This may have influenced their willingness to participate, fidelity and continued engagement when dealing with constraints. Furthermore, future research would aim to record the number of patients who the interventions were offered to; and focus groups should be held with GDPs, to explore NHS provision of periodontal management from their perspective and compare it with the DHT focus group data.

8.5 Impact of research to date

8.5.1 Advisor to NHS England for a commissioning standard

The Chief Dental Officer for NHS England commenced work in Spring 2018 to create a commissioning standard that aimed to improve the flow of patients with type 2 diabetes and/or periodontitis between medical and dental clinical care pathways, leading to improved oral and general health outcomes. This work commenced with an economic analysis on cost effectiveness of early detection and treatment of periodontitis in patients with diabetes which I was able to assist with. Following on from this advisory work, I was invited to become a Member of the London Implementation Group for Diabetes and Oral Health which will inform a pilot trial of the aforementioned commissioning standard in London initially, before rolling it out in other areas of England. The group aim is that by working with local GPs and GDPs in London, they may identify contractual levers and/or initiatives which may be appropriate to enable a culture shift for collaboration between the medical and dental professions.

8.5.2 Ardens healthcare informatics diabetes template

The existence of the diabetes review template that includes an oral care section made by Ardens healthcare informatics (https://www.ardens.org.uk/), was discovered during the evaluation interview with the NP who was piloting the 'Discuss and refer to a GDP' intervention. To ascertain further information regarding the template, an email was sent to support@ardens.org.uk which led to personal communication with the chief executive officer, Dr Robert Greville-Heygate. The company is run by GPs who have experience of primary healthcare, however, the templates are constantly under review and the company welcomes user feedback for quality improvement purposes. The precise reason for the request to include an oral care section is unclear. The original version was fairly basic, consisting of two questions with drop down options: one relating to the presence of any oral health problems, 'no problems' or 'oral health problem'; and one relating to oral hygiene, 'poor oral hygiene' or 'good oral hygiene'. The section also had a free text space for notes. Dr Greville-Heygate was keen to learn about the bidirectional relationship between diabetes and periodontitis and the oral care section has been through various iterations since I began to communicate with him. The current version contains fields relating to gums, mouth, teeth, oral hygiene, notes, advice given on oral health and gum care, advice to inform GDP of diabetes, and to have annual check-ups; and there is an option to print a leaflet explaining the links between diabetes and periodontitis (Appendix 13). The template user can click onto field options that are linked to Read Codes.

8.5.3 Publication

Bissett SM, Presseau J, Rapley T, Preshaw PM. Uptake of best practice recommendations in the management of patients with diabetes and periodontitis: a cross-sectional survey of dental clinicians. *BDJ* 2018: in press (Appendix 15).

8.6 Proposals for future research

8.6.1 Indirect referrals for suspected diabetes

The patient who was indirectly referred by her GDP to her GP (Chapter 7) to ask for a diabetes blood test gave an account of her distressing experience and it is uncertain whether this is atypical. Future research could gather qualitative evidence of the experiences of referring GDPs, patients and GPs to further explore indirect referrals in this context. Furthermore, the pathway for GDP/DHT to indirectly refer a patient with periodontitis to their GP for a diabetes blood test may be improved by giving the patient a template referral letter to take to the appointment. The template letter in the NICE PH38 guidelines was considered

good because it contained key messages for the GP that endorsed the diabetes risk score. In this scenario, perhaps the letter would contain key messages to endorse the referral by referencing the evidence for the bidirectional relationship between diabetes and periodontitis. The evidence may be presented in the same way as the background evidence in the medical survey, shown in Table 8.1; or a different template could be developed by a codesign workshop of GDP/DHTs and GP/PNs, and subsequently piloted.

'Discuss and refer to a GDP' was one of the oral health interventions piloted and evaluated in Chapter 7. This intervention was piloted by a NP who used the Ardens diabetes template. As this template has an oral care section with associated Read Codes, further research could gather a report of the Read Codes to explore the use of the oral care section, and identify how many indirect referrals are made to a GDP. Furthermore, it would be useful to explore the effectiveness of indirect referrals of a patient with diabetes to a GDP for periodontal assessment, as it is uncertain whether signposting is effective in this context.

Table 8.1 Example of key references that could be incorporated into a template GP letter for the referral of a patient with periodontitis and suspected diabetes

Treating periodontitis (gum disease) can reduce HbA1c [4,5,6]

- Periodontitis impairs glycaemic control in people with diabetes[1] and diabetes is a major risk factor for periodontitis (increasing the risk of periodontitis 3-fold).[2]
- A Cochrane systematic review reported a reduction in HbA1c of 4.4 mmol/mol (0.4 percentage points) 3-4 months after periodontal therapy,[3] a clinical impact equivalent to that of many second-line pharmaceutical therapies for diabetes but without the risk of drug side-effects.

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1. Preshaw PM, Alba AL, Herrera D, Jepsen S, Konstantinidis A, Makrilakis K & Taylor R. Periodontitis and diabetes: a two-way relationship. *Diabetologia* 2012; **55:** 21-31.
2. Mealey BL & Oates TW. Diabetes mellitus and periodontal diseases. *Journal of Periodontology* 2006; **77:** 1289-1303.
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4. Borgnakke WS, Ylöstalo PV, Taylor GW & Genco RJ. Effect of periodontal disease on diabetes: systematic review of epidemiologic observational evidence. *Journal of Clinical Periodontology* 2013; **40:** S135-S152.
5. Janket SJ, Wightman A, Baird AE, Van Dyke TE & Jones JA. Does periodontal treatment improve glycemic control in diabetic patients? A meta-analysis of intervention studies. *Journal of Dental Research* 2005; **84:** 1154-1159.
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8.6.2 Access to periodontal management under NHS provision

Access to periodontal management under NHS provision was found to be problematic (Chapter 7); however these findings were based on the views of a small sample of patients and DHTs. Further qualitative and quantitative research looking at a larger sample size and a broader perspective that includes the views of GDPs would provide further insight into periodontal provision.

8.6.3 Dental professionals' use of guidelines

Whilst it has been reported that there are too many guidelines, it is unknown if the multiple recommendations from various sources in the case of dental recommendations for periodontal and diabetes management, increases the complexity of implementation for dental clinicians. Indeed, little is known about how dental professionals find guidelines, disseminate them to their team and implement them. Further research to explore dental clinicians' use of guidelines would provide valuable insight.

The dental recommendations that followed the EFP/IDF consensus report of periodontitis and diabetes, amongst other things, suggest that GDPs (in Europe) should offer a free dental check-up to their patients at certain time points. It would seem appropriate to offer patients with diabetes a free dental check-up, especially as they are offered free eye tests and prescriptions (if they are on medication), but it is unclear whether health service commissioners or dental clinicians would be favourable to this. Exploring the views of GDPs and commissioners regarding free dental check-ups would provide further insight into the recommendation and its implementation.

8.7 Conclusion

The results of this research suggest that nurses are most suited to implement oral health interventions in primary medical care, such as 'Discuss and refer to a GDP', as the intervention aligns to their job role of diabetes educator and the referral is indirect signposting. Notwithstanding, all the staff in the medical practice, especially the GPs as organisation leaders, should be supportive in order to validate the importance of the intervention. It is unclear whether an indirect referral of a patient with diabetes to a GDP will motivate a patient to seek access to dental care, and further research would be necessary to explore this; but a direct referral from a nurse, or GP, to a GDP would appear to be inherently problematic.

Despite the qualitative data suggesting that dental professionals value inter-professional collaboration with their medical colleagues, the mechanisms for this remain complex and challenging. Discussions relating to communication are littered with negative experiences of communication which clearly hinder negotiation. Furthermore, although not the primary focus of this research, exploration of inter-professional working led to discussion relating to dental referrals to a GP for diabetes assessment; and, whilst indirect referral may be preferred by GDP/DHTs, the qualitative account of a patient with periodontitis and suspected diabetes suggest that this may not be appropriate as it (unfairly) puts the patient (and GP) into a difficult position. Moreover, the NICE PH38 guidance provided an opportunity to further study dental referrals, especially with regard to the value of a template referral letter which contains evidence supporting the referral. Initial feedback would suggest that this may improve the indirect referral method, however further research into the development and implementation of such a template is required.

Difficulties in creating MDTs and collaborative working have been reported in the literature, especially when the GP is unfamiliar with the other professionals. The results of this research found that the addition of a DHT into a diabetes team was considered feasible and acceptable; and further research may explore this as a way of integrating periodontal management into diabetes management. Notwithstanding, engagement strategies should be considered to encourage interaction between medical and dental professionals in the context of diabetes and periodontitis. An example of such engagement could be a GDP or DHT presenting the evidence that links diabetes and periodontitis to medical colleagues during a diabetes or practice meeting, as the researcher (SMB) did in Chapter 6. This may provide a platform to discuss preferred methods of communication and referral, from dental professional to GP and nurse and vice versa. Furthermore, if GDPs (and DHTs) offered to directly communicate with a designated pharmacist instead of the GP in patient matters relating to prescribing, this gesture may demonstrate a positive intention and work to build trust that has been shown to enable effective collaboration.

Appendices

Appendix 1 Department of Health template GP letter

Appendix 6.1 – Template letter for GDP to contact diabetes physician

Practice details

Diabetes physician details

Dear

RE: Name:
DoB:
Address:
NHS number if known:

I am managing the periodontal health of and I understand they attend your diabetes clinic. As you know, diabetes can increase the risk of periodontal disease and compromise treatment, particularly with unstable glycaemic control (typically HbA1c more than 7.0%). I would therefore be grateful for your advice on their diabetes control and recent HbA1c levels would be helpful.

Thank you in advance for your help

Yours sincerely

Dentist details

Copy: Patient's name

Appendix 2 NICE PH38 diabetes risk score questionnaire

University of Leicester | University Hospitals of Leicester NHS NHS Trust | DiABETES UK CARE. CONNECT. CAMPAIGN.

DIABETES RISK SCORE

QUESTIONS

1 How old are you?

A 49 or younger	[0]
B 50–59	[5]
C 60–69	[9]
D 70 or older	[13]

2 Are you female or male?

A Female	[0]
B Male	[1]

3 What is your ethnic background?

A Only white European	[0]
B Other ethnic group	[6]

4 Do you have a father, mother, brother, sister and/or own child with Type 1 or Type 2 diabetes?

A Yes	[5]
B No	[0]

5 Measure the person's waist circumference and choose the range:

A Less than 90cm (35.3in)	[0]
B 90–99.9cm (35.4–39.3in)	[4]
C 100–109.9cm (39.4–42.9in)	[6]
D 110cm (43in) or above	[9]

6 Calculate the person's Body Mass Index (BMI) and choose the range (a BMI chart can be used).

A Less than 25	[0]
B 25–29.9	[3]
C 30–34.9	[5]
D 35 or above	[8]

7 Have you been given medicine for high blood pressure OR told that you have high blood pressure, by your doctor?

A Yes	[5]
B No	[0]

Your score is: _____ points

Risk level	Chances of having Type 2 diabetes now	Chance of high blood glucose now, meaning risk risk of Type 2 in 10 years	What you need to do
0–6 points (Low risk)	1 in 200	1 in 20	Keep up the good work, make lifestyle adjustments to further reduce risk.
7–15 points (Increased risk)	1 in 50	1 in 10	Make lifestyle changes.
16–24 points (Moderate risk)	1 in 33	1 in 7	See your GP to discuss your risk and how to reduce it.
25 or more points (High risk)	1 in 14	1 in 3	See your GP **as soon as possible** for a blood test.

Appendix 3 NICE PH38 template GP letter

Today's date _____

Venue/event_____

Name of helper_____

Patient's name _____

Address _____

_____Postcode_____

Patient's date of birth (DD/MM/YYYY)_____

Dear Doctor,

Today the person named above attended Type 2 diabetes screening in your local area using Diabetes UK's Diabetes Risk Score. According to their risk score, their risk of developing diabetes within the next 10 years is:

☐ Moderate (an estimated 1 in 33 chance of having Type 2 diabetes and a 1 in 7 chance of having non-diabetic hyperglycaemia).

☐ High (an estimated 1 in 14 chance of having Type 2 diabetes and a 1 in 3 chance of having non-diabetic hyperglycaemia).

Diabetes UK recommends that your patient should now:

☐ (Moderate risk) Attend clinic for further follow up, possible tests and referral for lifestyle advice. We have advised your patient to make an appointment to see you.

☐ (High or moderate risk) Attend clinic for Type 2 diabetes diagnostic tests and lifestyle advice.

We have advised your patient to make an appointment to see you.

Yours faithfully _____

NOTES FOR GPs

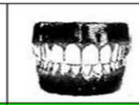
The Type 2 diabetes risk score can be used to reliably identify those at high risk of IGR in multi-ethnic populations. The score is simple (seven questions), non invasive and applicable to a wide variety of settings.

- This tool can be used as part of a first stage screening strategy in line with the NHS Health Check programme and a recommendation for screening for Type 2 diabetes.
- It was developed using data from 6,390 subjects aged 40–75 from the ADDITION-Leicester screening study from a multi ethnic UK setting (76% White European, 22% South Asian, 3% other). All participants were given a 75g Oral Glucose Tolerance Test.
- It was developed using logistic regression models for predicting IGR (IFG/IGT/T2DM) using data from self-reported questionnaires.
- The best fitting model externally validated the tool, using data from 3,298 subjects aged 40–75 screened as part of a previous independent screening study.
- The format and design elements were piloted in a local patient population on several occassions to establish the clearest method of providing the risk score and communication of the results.

Appendix 4 Dental Cross Disciplinary Index (DXDI) – original version

Diabetes Cross-Disciplinary Index (DXDI©)

Western University Western Diabetes Institute

DXDI Stage	 A1C		 LDL_c							BMI	
1	<7.0 (<53 mmol/mol)	No Symptoms & No Structural Heart Disease	< 100 or <70 with CVD	SBP < 130 DBP < 80	No Nephropathy	No Retinopathy	No Dental Infection	No Neuropathy No PAD	Independent	18.5-24.9	No Depression
2	7.0-7.9 (53-63 mmol/mol)	No Symptoms & + Structural Heart Disease	101-130	SBP 130-139 DBP < 90	Albuminuria 30-299	Non-Proliferative Mild	Mild Gingival Inflammation	+Neuropathy	Modified Independent	25-29.9	Minimal Depression
3	8.0-8.9 (64-74 mmol/mol)	Symptomatic & + Structural Heart Disease	131-160	SBP 140-149 DBP < 90	Albuminuria 300-999 or eGFR 30- 60	Non-Proliferative Moderate	Moderate Gingival Inflammation	+PAD & +/- Neuropathy	Minimal Assist 75%	30-34.9	Mild Depression
4	9.0-9.9 (75-85 mmol/mol)	Symptomatic w/ Heart Failure	161-190	SBP <150 DBP 90-99	Albuminuria 1000-2999 or eGFR 15-29	Non-Proliferative Severe/ Inactive Proliferative	Severe Gingival Inflammation	+ Ulcer History	Moderate Assist 50%	35-39.9	Moderate Depression
5	≥ 10.0 (≥86 mmol/mol)	Refractory Heart Failure	>191	SBP ≥ 150 -or- DBP ≥ 100	Albuminuria ≥3,000 or eGFR <15	Active Proliferative	Acute Dental Infection	+ Previous Amputation	Dependent High safety Risk	≥40 or <18.5	Severe Depression

Appendix 5 Dental Cross Disciplinary Index (DXDI) – current version

Diabetes Cross-Disciplinary Index (DXDI©)

Western University Western Diabetes Institute

	 A1C	 LDL_c							BMI	WC		
1	<7.0% (<53 mmol/mol)	< 100 mg/dL or <70 with CVD	SBP < 130 mmHg and DBP < 80 mmHg	No Nephropathy	No Retinopathy	Periodontal Health PD ≤3 mm & BOP≤15%	LOW RISK: No risk factors present	Independent	18.5-24.9	Women: ≤76 cm (≤30 in) Men: ≤89 cm (≤35 in)	No Depression PHQ-9 Score 0	Non-smoker or Stopped smoking >15 yrs
2	7.0-7.9 (53-63)	100-130	SBP 130-139 and DBP < 90	Albuminuria UACR 30-299 mg/g	Mild Non-Proliferative	Gingivitis PD ≤4 mm &/or BOP >15%		Modified Independent	25-29.9	Women: >76 - ≤83 (>30 - ≤33) Men: >89 - ≤94 (>35 - ≤37)	Minimal Depression PHQ-9 Score 1-4	Stopped smoking >10 yrs
3	8.0-8.9 (64-74)	131-160	SBP 140-149 and DBP < 90	Albuminuria UACR 300-999 or eGFR 30-60	Moderate Non-Proliferative	Mild-moderate Periodontitis PD =5 mm @ ≥1 site	MODERATE RISK: One risk factor present (neuropathy / PVD / callus / deformity)	Minimal Assist 75%	30-34.9	Women: >83 - ≤89 (>33 - ≤35) Men: >94 - ≤100 (>37 - ≤39.5)	Mild Depression PHQ-9 Score 5-9	Stopped smoking >5 yrs
4	9.0-9.9 (75-85)	161-190	SBP <150 and DBP 90-99	Albuminuria UACR 1000-2999 or eGFR 15-29	Severe Non-Proliferative or Inactive Proliferative	Localized Advanced Periodontitis PD ≥6 mm @ ≤30% of sites	HIGH RISK: Previous ulceration or amputation or >1 risk factor	Moderate Assist 50%	35-39.9	Women: >89 - ≤98 (>35 - ≤39) Men: >100 - ≤106 (>39.5 - ≤42)	Moderate Depression PHQ-9 Score 10-14	Stopped smoking >1 yr
5	≥ 10.0 (≥86) or Medication-induced hypoglycemia	>191	SBP ≥ 150 or DBP ≥ 100	Albuminuria UACR ≥3000 or eGFR ≤15	Active Proliferative	Generalized Advanced Periodontitis PD ≥6 mm @ >30% of sites	ACTIVE FOOT DISEASE	Dependent High safety Risk	≥40 or <18.5	Women: >98 (>39) Men: >106 (>42)	Severe Depression PHQ-9 Score ≥15	Active smoker

V8.3_RevMay2016

Appendix 6 Medical professionals' questionnaire

Block 1

Survey completion instructions.

The **purpose of this survey** is to assess the clinical practices of healthcare professionals with regard to their patients with **poorly controlled diabetes** (HbA1c > 58mmol/mol or > 7.5%). **All surveys are confidential.**
If you manage patients with diabetes, you are invited to complete this survey. Completion will take **around 30 minutes, for which you will be remunerated** at your professional rate.
The survey has 21 questions separated into two sections: section 1 asks **6 questions** about you; and section 2 **(15 questions),** asks about the management of your patients with diabetes who are poorly controlled (HbA1c > 58mmol/mol or > 7.5%).
Please read each question carefully and answer it to the best of your ability. **There are no correct or incorrect responses**; we are merely interested in your point of view. The survey may appear to be repetitive since several of the statements are worded in a similar manner. It is the nature of this study that entails this methodological approach. We would **really appreciate your involvement**, as we wish to obtain **a 'snapshot' of current practice** in the UK regarding the dental management of people with diabetes.

Treating periodontitis (gum disease) can reduce HbA1c [4,5,6]

- Periodontitis impairs glycaemic control in people with diabetes1 and diabetes is a major risk factor for periodontitis (increasing the risk of periodontitis 3-fold).2

- A Cochrane systematic review reported a reduction in HbA1c of 4.4 mmol/mol (0.4 percentage points) 3-4 months after periodontal therapy,3 a clinical impact equivalent to that of many second-line pharmaceutical therapies for diabetes but without the risk of drug side-effects.

Aim of the research:

- The purpose of this survey is to find out the views and perspectives of healthcare professionals who manage patients with diabetes regarding the evidence supporting the links between diabetes and periodontitis.

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Please click the arrows on the bottom right of the page to proceed.

Default Question Block

SECTION 1

Please answer these questions about yourself

Q1. Sex

Male ○ Female ○

Q2. Job

- ○ Community nurse
- ○ Diabetes nurse specialist
- ○ Diabetologist
- ○ Dietician
- ○ GP
- ○ GP with specialist interest in diabetes (with or without qualification)
- ○ GP with specialist interest in other area
- ○ Podiatrist
- ○ Practice nurse
- ○ Other (please specify)

Q3. Age

- ○ < 30
- ○ 30 - 40
- ○ 40 - 50
- ○ 50 - 60
- ○ > 60

Q4. Year of most recent professional qualification (yyyy - approximate is fine)?

Q5. How many patients with diabetes (either type 1 or 2) do you see in an average month?

Q6. Please use this space to clarify any responses or write any comments, if you would like to.

Block 2

SECTION 2

Please read each question carefully and answer it to the best of your ability.
There are no correct or incorrect responses; we are merely interested in your point of view.

Q7.
Thinking of **your last 10 patients with diabetes who you had a conversation with regarding their poor HbA1c levels (i.e. > 58 mmol/mol or > 7.5%).**

How many have you informed about the links between diabetes and periodontitis?

For example, if you inform everyone, then circle 10. If you inform some but not all, then chose a number which represents the proportion that you inform.

0 1 2 3 4 5 6 7 8 9 10

Q8.
Thinking of **your last 10 patients with diabetes who you had a conversation with regarding their poor HbA1c levels (i.e. > 58 mmol/mol or > 7.5%).**

How many have you ssuggested to go for a dental check-up?

For example, if you suggest it to everyone, then circle 10. If you inform some but not all, then chose a number which represents the proportion that you inform.

0 1 2 3 4 5 6 7 8 9 10

Q9.
This question refers to **informing your patients with diabetes about the links between diabetes and periodontitis, during a conversation regarding their poor HbA1c levels (i.e. > 58 mmol/mol or > 7.5%).**

For each statement please **read the stem carefully first**, then select an answer that best suits your experience using the options.

For example, take a look at the stem and the first statement below and read them carefully. If you feel confident that you can inform your patient about the links between diabetes and periodontitis even when work is busy, then choose option 'Strongly Agree' or 'Agree'. If you feel that work being busy may affect your confidence in informing your patient about the links, then choose option 'Disagree' or 'Strongly Disagree'. If you are not sure, choose 'Neither agree nor disagree'. Now re-read the stem followed by the next statement, and so on.

Stem: I am confident that I can inform my patients with diabetes about the links between diabetes and periodontitis EVEN WHEN...

Statements:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
... work is busy	○	○	○	○	○
... it is someone else's responsibility	○	○	○	○	○
... there is already too much to do	○	○	○	○	○
... it is not a priority for me	○	○	○	○	○
... it is not a priority for the patient	○	○	○	○	○
... I am not set up for it	○	○	○	○	○
... there are problems accessing dental services	○	○	○	○	○
... I am running late	○	○	○	○	○
... the patient has very few of their own teeth	○	○	○	○	○
... the patient seems to have good dental health	○	○	○	○	○
... my colleagues are doing the same	○	○	○	○	○
... my colleagues are not doing the same	○	○	○	○	○

Q10.
This question refers to **informing your patients with diabetes about the links between diabetes and periodontitis, during a conversation regarding their poor HbA1c levels (i.e. > 58 mmol/mol or > 7.5%).**

Stem: I am confident **that I can provide a suggestion to go for a dental check-up *EVEN* WHEN...**

Statements:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
... work is busy	○	○	○	○	○
... it is someone else's responsibility	○	○	○	○	○
... there is already too much to do	○	○	○	○	○
... it is not a priority for me	○	○	○	○	○
... it is not a priority for the patient	○	○	○	○	○

... I am not set up for it	○	○	○	○	○
... there are problems accessing dental services	○	○	○	○	○
... I am running late	○	○	○	○	○
... the patient has very few of their own teeth	○	○	○	○	○
... the patient seems to have good dental health	○	○	○	○	○
... my colleagues are doing the same	○	○	○	○	○
... my colleagues are not doing the same	○	○	○	○	○

Q11.
This question is about **informing your poorly controlled patients with diabetes (HbA1c > 58 mmol/mol or > 7.5%) about the links between diabetes and periodontitis.**

Please read the statements carefully and chose an appropriate option.

	OPTIONS							
	Strongly agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Not relevant to my role	Not relevant at this stage	Not relevant to diabetes care
Statement 1: I can see how informing patients about the links between diabetes and periodontitis differs from my usual way of working	○	○	○	○	○	○	○	○
Statement 2: Staff in this organisation have a shared understanding of the purpose of informing patients about the links between diabetes and periodontitis	○	○	○	○	○	○	○	○
Statement 3: I understand how informing patients about the links between diabetes and periodontitis affects the nature of my own work	○	○	○	○	○	○	○	○
Statement 4: I can see the potential value of informing patients about the links between diabetes and periodontitis for my work	○	○	○	○	○	○	○	○
Statement 5: I believe that informing patients about the links between diabetes and periodontitis is a legitimate part of my role	○	○	○	○	○	○	○	○

Q12.
This question relates to **suggesting that your patients with HbA1c > 58 mmol/mol or > 7.5%, should go for a dental check-up.**

Please read the statements carefully and chose an appropriate option.

	OPTIONS							
	Strongly agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Not relevant to my role	Not relevant at this stage	Not relevant to diabetes care
Statement 1: I can see how suggesting that your patients with HbA1c > 58 mmol/mol or > 7.5%, should go for a dental check-up differs from my usual way of working	○	○	○	○	○	○	○	○
Statement 2: Staff in this organisation have a shared understanding of the purpose of suggesting that your patients with HbA1c > 58 mmol/mol or > 7.5%, should go for a dental check-up	○	○	○	○	○	○	○	○
Statement 3: I understand how suggesting that your patients with HbA1c > 58 mmol/mol or > 7.5%, should go for a dental check-up affects the nature of my own work	○	○	○	○	○	○	○	○
Statement 4: I can see the potential value of suggesting								

that your patients with HbA1c > 58 mmol/mol or > 7.5%, should go for a dental check-up for my work	○	○	○	○	○	○	○	○
Statement 5: I believe that suggesting that your patients with HbA1c > 58 mmol/mol or > 7.5%, should go for a dental check-up is a legitimate part of my role	○	○	○	○	○	○	○	○

Q13.
Informing them about the links between diabetes and periodontitis will help my poorly controlled patients with diabetes (HbA1c > 58 mmol/mol or > 7.5%)?

Not at all	A little	Moderately	Quite a bit	Extremely
○	○	○	○	○

Q14.
Suggesting that they go for a dental check-up will help my patients with poorly controlled diabetes (HbA1c > 58 mmol/mol or > 7.5%)?

Not at all	A little	Moderately	Quite a bit	Extremely
○	○	○	○	○

Q15.
Iinforming my patients with poorly controlled diabetes (HbA1c > 58 mmol/mol or > 7.5%) about the links between diabetes and periodontitis, will be a good use of my time?

Never	Rarely	Sometimes	Often	All of the Time
○	○	○	○	○

Q16.
Suggesting that my patients with poorly controlled diabetes (HbA1c > 58 mmol/mol or >7.5%) go for a dental check-up will be a good use of my time?

Never	Rarely	Sometimes	Often	All of the Time
○	○	○	○	○

Q17.
This question asks about the **timing** of **informing** patients about the links between diabetes and periodontitis and **suggesting** to have a dental check-up. Please read the question and tick as many options as you like.

OPTIONS:

	QUESTIONS:	
	Q1: When is a good time to inform patients about the links between diabetes and periodontitis?	**Q2**: When is a good time to suggest having a dental check-up?
Never	☐	☐
At time of periodontal diagnosis	☐	☐
At time of diabetes diagnosis	☐	☐
At their routine dental check-up appointment	☐	☐
Alongside discussion regarding their HbA1c	☐	☐
When the patient has poorly controlled diabetes	☐	☐
When the patient is facing being prescribed oral medication (or additional oral medication) for their diabetes	☐	☐
When the patient is facing being put onto insulin or other injectables	☐	☐
At their first appointment in the practice	☐	☐
When the periodontal condition deteriorates	☐	☐
Other	☐	☐

Q18.
This question asks about the **timing** of **informing** patients about the links between diabetes and periodontitis and **suggesting** to have a dental check-up. Please read the question and tick as many options as you like.

	OPTIONS - choose as many as you like							
	No one	GP	GP with special interest in diabetes	Dietician	Diabetologist	Dentist	Dental hygienist/therapist	Other
Q1: Who **could** inform about the links between diabetes and periodontitis?	☐	☐	☐	☐	☐	☐	☐	☐
Q2: Who **should** inform about the links between diabetes and periodontitis?	☐	☐	☐	☐	☐	☐	☐	☐
Q3: Who **could** suggest having a dental check-up?	☐	☐	☐	☐	☐	☐	☐	☐
Q4: Who **should** suggest having a dental check-up?	☐	☐	☐	☐	☐	☐	☐	☐

Q19.
This question relates to **your next 10 patients with poorly controlled diabetes (HbA1c>58 mmol/mol or > 7.5%).**

How many do you intend to inform about the links between diabetes and periodontitis?

Q20.
This question relates to **your next 10 patients with poorly controlled diabetes (HbA1c>58 mmol/mol or > 7.5%).**

How many do you intend to suggest going for a dental check-up?

Q21. Please use this space to clarify any responses or write any comments, if you would like to.

Version 1.0

Appendix 7 Primary medical care practice information sheet

SUMMARY PRACTICE INFORMATION SHEET

Version 1.1 20/01/2016

Developing oral health initiatives to improve glycaemic control

What is this study about?

People with diabetes are at increased risk of developing periodontitis, which can adversely impact on their diabetes control. The long term aim of this research is to reduce the present gap that exists between evidence and practice in the area of diabetes and periodontitis by working with: healthcare professionals (HCPs) to improve their knowledge and awareness of the recognised bidirectional relationship between diabetes and periodontitis; and both HCPs and people with diabetes (PWD) to co-design an intervention that will bring the oral health needs of PWD into focus within a diabetes context.

Study aim: the overall study aim is to reduce the gap between evidence and practice in the area of diabetes and periodontitis. The present project aims to address this by initially carrying out a survey of HCPs and dental professionals (DPs) regarding their current management of PWD and their views about the inclusion of oral health initiatives into the routine management of diabetes care.

What is involved for Practices?

Practice telephone interview with a nominated member of staff to obtain demographic data about the practice and explore the organisational and individual drivers to patient care. **Healthcare Professional e-surveys** is to elicit the clinical behaviour of healthcare professionals with regard to their patients with poorly controlled diabetes (HbA1c > 58mmol/mol or > 7.5%). **The survey has two sections**: section 1 asks **5 questions** about you; and section 2 **(16 questions),** asks about the management of your patients with diabetes. All surveys are anonymous and confidential. Completion should take **around 30 minutes, for which you will be remunerated** at your professional rate.

Inclusion criteria: The study aim is to obtain a wide range of views and opinions and the inclusion criteria are intentionally broad: Any practice member who manages a patient with diabetes and has sufficient English language skills to participate is eligible. There are no exclusion criteria.

Remuneration: Payment will be offered for completing surveys calculated on rates for the healthcare professional professional time. [GP: £80 per hour. Nurses: £21.88 per hour. HCAs: £10.66 per hour.]

Sponsor: Newcastle upon Tyne Hospitals Foundation Trust

Portfolio #: UKCRN 20477

Funder: National Institute Health Research Doctoral Research Fellowship (reference number 10669)

Contact: Chief Investigator Susan Bissett NIHR Clinical Research Fellow Clinical Research Facility Level 4 Dental Hospital Richardson Road Newcastle upon Tyne NE2 4AZ 0191 208 8319 Email: s.m.bissett@ncl.ac.uk	Contact: Sally Dunn Research Facilitator/Acting Research Manager North of England Commissioning Support (NECS) NECS Research and Development, 2nd Floor, Riverside House, Goldcrest Way, Newburn Riverside (Business Park) Newcastle upon Tyne. NE15 8NY Tel: 0191 2172522 07531101305 (mobile) Email: sally.dunn5@nhs.net www.necsu.nhs.uk

Many thanks for reading this study summary and giving it your consideration.

If you would like further information about the study, please contact the Chief Investigator above.

Appendix 8 Dental professionals' questionnaire

Block 1

Survey completion instructions.

The **purpose of this survey** is to assess the clinical practices of BSP members with regard to the management of their **patients with diabetes**, focusing particularly on those **with poor diabetes control** (which would be described as glycated haemoglobin, HbA1c, >58mmol/mol or >7.5%). **All surveys are confidential.**

As **a member of the BSP, working in the UK**, you are invited to complete this survey, which should take about **30 minutes**. We are sending this survey to **all** UK members of the BSP, including dental hygienists and dental therapists.

There are **33 questions** separated into **2 sections**: section 1 asks 12 questions about yourself and your clinical practise; section 2 (21 questions), asks about the management of your patients with diabetes, particularly those who are poorly controlled.

Submission of a completed survey will enter you into a **prize draw** to win one of ten amazon vouchers worth **£100 each**.

Please read each question carefully and answer it to the best of your ability. There are **no correct or incorrect responses**; we are merely interested in your point of view. The survey may sometimes appear to be repetative since several of the statements are worded in a similar manner. It is the nature of this study that entails this methodological approach. We would **really appreciate your involvement**, as we wish to obtain a **'snapshot' of current practice** in the UK regarding the dental management of people with diabetes.

Please click the arrows on the bottom right of the page to proceed

Default Question Block

SECTION 1

Please answer these questions about yourself

Q1. Sex

Male ○ Female ○

Q2.
Main job role (please indicate one in either primary or secondary care)

- ○ Principal GDP
- ○ Associate GDP
- ○ VT GDP
- ○ GDP
- ○ Specialist GDP
- ○ Dental hygiene/therapist
- ○ Dental hygienist
- ○ Specialist registrar

- ○ Senior house officer
- ○ Consultant
- ○ Staff dental hygienist / therapist
- ○ Staff dental hygienist
- ○ Clinical academic / honorary consultant
- ○ Other

Q3. Year of first registration with GDC (yyyy)

Q4. Year of most recent professional qualification (approximate is fine).

Q5. Age

- ○ < 30
- ○ 30 - 40
- ○ 40 - 50
- ○ 50 - 60
- ○ > 60

Q6. Are you on the GDC specialist list in periodontics?

- ○ Yes
- ○ No

Q7. What percentage of your working time do you spend in:

Q8. What percentage of clinical time do you spend in the practise of periodontology (whether in primary or secondary care)?

Q9. This question only applies to those working in **primary care.**

Thinking about your patients who need periodontal treatment, please indicate the approximate percentage of patients who receive that treatment under:

the NHS 0

Private fee per item	0
Denplan or other regular payment plan	0
Other	0
Total	0

Q10. If you are a **dentist in primary care**, please indicate the percentage of your patients who need periodontal treatment that:

You treat yourself	0
You refer to a hygienist/therapist for treatment	0
You refer elsewhere	0
Total	0

Q11.
This question is for everyone:
Approximately, how many patients with diabetes (either type 1 or type 2) do you see in an average month?

Q12. Please use this space to clarify any responses or write any comments, if you would like to.

Block 2

SECTION 2

Please read each question carefully and answer it to the best of your ability.
There are no correct or incorrect responses; we are merely interested in your point of view.

Q13.
Thinking of **your last 10 patients with periodontal disease and diabetes, particularly those with poor diabetes control,**

how many have you **informed** about the links between diabetes and periodontitis?

Use the slider to indicate your response.

0 1 2 3 4 5 6 7 8 9 10

Q14.
Thinking of **your last 10 patients with periodontal disease and diabetes, (particularly those with poor diabetes control) for whom you provided periodontal treatment,**

for **how many** did you consider the impact of the periodontal treatment on their diabetic control?

0 1 2 3 4 5 6 7 8 9 10

Q15.
Thinking of **your last 10 patients with periodontal disease and diabetes, particularly those with poor diabetes control,**

how many have you **contacted their doctor** with regard to their periodontal disease and poorly controlled diabetes?

0 1 2 3 4 5 6 7 8 9 10

Q16.
This question refers to **informing your patients with diabetes about the links between diabetes and periodontitis, particularly those with poor diabetes control.**

For each **statement** please **read the stem carefully first**, then select an answer that best suits your experience using the options.

For example, take a look at the stem and the first statement below and read them carefully. If you feel confident that you can inform your patient about the links between diabetes and periodontitis even when work is busy, then choose option 'Strongly Agree' or 'Agree'. If you feel that work being busy may affect your confidence in informing your patient about the links, then choose option 'Disagree' or 'Strongly Disagree'. If you are not sure, choose 'Neither agree nor disagree'. Now re-read the stem followed by the next statement, and so on.

Stem: I am confident that I can inform my patients with diabetes about the links between diabetes and periodontitis EVEN WHEN...
Statements:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
... work is busy	○	○	○	○	○
... it is someone else's responsibility	○	○	○	○	○
... there is already too much to do	○	○	○	○	○
... it is not a priority for me	○	○	○	○	○
... it is not a priority for the patient	○	○	○	○	○
... I am not set up for it	○	○	○	○	○
... there are problems accessing dental services	○	○	○	○	○
... I am running late	○	○	○	○	○
... the patient has very few of their own teeth	○	○	○	○	○
... the patient seems to have good dental health	○	○	○	○	○
... my colleagues are doing the same	○	○	○	○	○
... my colleagues are not doing the same	○	○	○	○	○

Q17.
This question refers to **considering the impact of periodontal treatment on their poor diabetic control.**

Stem: **I am confident that I consider the impact of periodontal treatment on poor diabetic control EVEN *WHEN*...**
Statements:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

... work is busy	○	○	○	○	○
... it is someone else's responsibility	○	○	○	○	○
... there is already too much to do	○	○	○	○	○
... it is not a priority for me	○	○	○	○	○
... it is not a priority for the patient	○	○	○	○	○
... I am not set up for it	○	○	○	○	○
... there are problems accessing dental services	○	○	○	○	○
... I am running late	○	○	○	○	○
... the patient has very few of their own teeth	○	○	○	○	○
... the patient seems to have good dental health	○	○	○	○	○
... my colleagues are doing the same	○	○	○	○	○
... my colleagues are not doing the same	○	○	○	○	○

Q18.

This question refers to **contacting your patient's doctor with regard to their periodontal disease and poorly controlled diabetes.**

Stem: **I am confident that I can contact my patient's doctor with regard to their periodontal disease and poorly controlled diabetes *EVEN WHEN*...**

Statements:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
... work is busy	○	○	○	○	○
... it is someone else's responsibility	○	○	○	○	○
... there is already too much to do	○	○	○	○	○
... it is not a priority for me	○	○	○	○	○
... it is not a priority for the patient	○	○	○	○	○
... I am not set up for it	○	○	○	○	○
... there are problems accessing dental services	○	○	○	○	○
... I am running late	○	○	○	○	○
... the patient has very few of their own teeth	○	○	○	○	○
... the patient seems to have good dental health	○	○	○	○	○
... my colleagues are doing the same	○	○	○	○	○
... my colleagues are not doing the same	○	○	○	○	○

Q19.

This question is about **informing your patients with diabetes (particularly those with poorly controlled diabetes) about the links between diabetes and periodontitis.**

Please read the statements carefully and chose an appropriate option.

OPTIONS

	Strongly agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Not relevant to my role	Not relevant at this stage	Not relevant to diabetes care
Statement 1: I can see how informing patients about the links between diabetes and periodontitis differs from my usual way of working	○	○	○	○	○	○	○	○
Statement 2: Staff in this organisation have a shared understanding of the purpose of informing patients about the links between diabetes and periodontitis	○	○	○	○	○	○	○	○
Statement 3: I understand how informing patients about the links between diabetes and periodontitis affects the nature of my work	○	○	○	○	○	○	○	○
Statement 4: I can see the potential value of informing patients about the links between diabetes and periodontitis for my work	○	○	○	○	○	○	○	○
Statement 5: I believe that informing patients about the links between diabetes and periodontitis is a legitimate part of my role	○	○	○	○	○	○	○	○

Q20.

This question relates to **considering the impact of periodontal treatment on poor diabetic control.**

OPTIONS

	Strongly agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Not relevant to my role	Not relevant at this stage	Not relevant to diabetes care
Statement 1: I can see how considering the impact of periodontal treatment on poor diabetic control differs from my usual way of working	○	○	○	○	○	○	○	○
Statement 2: Staff in this organisation have a shared understanding of the impact of periodontal treatment on poor diabetic control	○	○	○	○	○	○	○	○
Statement 3: I understand how considering the impact of periodontal treatment on poor diabetic control affects the nature of my work	○	○	○	○	○	○	○	○
Statement 4: I can see the potential value of considering the impact of periodontal treatment on poor diabetic control for my work	○	○	○	○	○	○	○	○
Statement 5: I believe that considering the impact of periodontal treatment on poor diabetic control is a legitimate part of my role	○	○	○	○	○	○	○	○

Q21.

This question relates to **contacting the patient's doctor about their periodontal disease and poorly controlled diabetes.**

OPTIONS

	Strongly agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Not relevant to my role	Not relevant at this stage	Not relevant to diabetes care
Statement 1: I can see how contacting the patient's doctor about their periodontal disease and poorly controlled diabetes differs from my usual way of working	○	○	○	○	○	○	○	○
Statement 2: Staff in this organisation have a shared understanding of the purpose of contacting a patient's doctor about their periodontal disease and poorly controlled diabetes	○	○	○	○	○	○	○	○
Statement 3: I understand how contacting the patient's doctor about their periodontal disease and poorly controlled diabetes affects the nature of my own work	○	○	○	○	○	○	○	○
Statement 4: I can see the potential value of contacting the patient's doctor about their periodontal disease and poorly controlled diabetes for my work	○	○	○	○	○	○	○	○

Statement 5: I believe that contacting the patient's doctor about their periodontal disease and poorly controlled diabetes is a legitimate part of my role	○	○	○	○	○	○	○	○

The next 6 questions relate to **your patient management**.

Q22.
Informing about the links between diabetes and periodontitis will help my patients with diabetes, (particularly those with poor diabetic control)?

Not at all	A little	Moderately	Quite a bit	Extremely
○	○	○	○	○

Q23.
Considering the impact of the periodontal treatment on their poorly controlled diabetes will help my patients?

Not at all	A little	Moderately	Quite a bit	Extremely
○	○	○	○	○

Q24.
Contacting the doctor with regard to my patient's periodontal disease and poorly controlled diabetes will **help** the patient?

Not at all	A little	Moderately	Quite a bit	Extremely
○	○	○	○	○

Q25.
Informing patients about the links between diabetes and periodontitis will be a **good** use of my time?

Never	Rarely	Sometimes	Often	All of the Time
○	○	○	○	○

Q26.
Considering the impact of periodontal treatment on diabetic control will be a **good** use of my time?

Never	Rarely	Sometimes	Often	All of the Time
○	○	○	○	○

Q27.
Contacting the doctor with regard to my patient's periodontal disease and poorly controlled diabetes will be a **good** use of my time?

Never	Rarely	Sometimes	Often	All of the Time
○	○	○	○	○

Q28.
This question asks about the **timing** of **informing** patients about the links between diabetes; **considering** the impact of periodontal treatment on diabetic control; and **contacting** the doctor with regard to the patients periodontal disease and their poorly controlled diabetes.

Please read the question and choose as many options as you like.

OPTIONS:

QUESTIONS

Version 1.0

	Q1: When is a good time to inform patients about the links between diabetes and periodontitis?	**Q2**: When is a good time to consider the impact of periodontal treatment on diabetic control?	**Q3**: When is a good time to contact the patient's doctor with regard to their periodontal disease and poorly controlled diabetes?
Never	☐	☐	☐
At time of periodontal diagnosis	☐	☐	☐
At time of diabetes diagnosis	☐	☐	☐
At their routine dental check-up appointment	☐	☐	☐
Alongside discussion regarding their HbA1c	☐	☐	☐
When the patient has poorly controlled diabetes	☐	☐	☐
When the patient is facing being prescribed oral medication (or additional oral medication) for their diabetes	☐	☐	☐
When the patient is facing being put onto insulin or other injectables	☐	☐	☐
At their first appointment in the practice	☐	☐	☐
When the periodontal condition deteriorates	☐	☐	☐
Other	☐	☐	☐

Q29.
This question is about **who** could/should **inform** about the links, **consider** the impact of periodontal treatment on diabetic control and **contact** the patients GP.

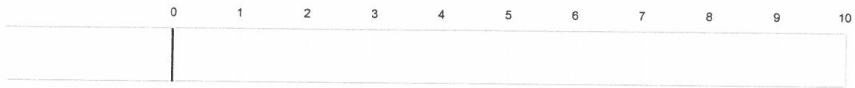
Please read the question and choose as many options as you like.

QUESTIONS:

	OPTIONS - choose as many as you like							
	No one	GP	GP with special interest in diabetes	Dietician	Diabetologist	Dentist	Dental hygienist / therapist	Other
Q1: Who **could** inform about the links between diabetes and periodontitis?	☐	☐	☐	☐	☐	☐	☐	☐
Q2: Who **should** inform about the links between diabetes and periodontitis?	☐	☐	☐	☐	☐	☐	☐	☐
Q3: Who **could** consider the impact of periodontal treatment on diabetic control?	☐	☐	☐	☐	☐	☐	☐	☐
Q4: Who **should** consider the impact of periodontal treatment on diabetic control?	☐	☐	☐	☐	☐	☐	☐	☐
Q5: Who **could** contact the patient's doctor with regard to their periodontal disease and poorly controlled diabetes?	☐	☐	☐	☐	☐	☐	☐	☐
Q6: Who **should** contact the patient's doctor with regard to their periodontal disease and poorly controlled diabetes?	☐	☐	☐	☐	☐	☐	☐	☐

Q30.
This question relates to **your next 10 patients with periodontal disease and poorly controlled diabetes.**

How many do you **intend to inform** about the links between diabetes and periodontitis?



Q31.

This question relates to **your next 10 patients with periodontal disease and poorly controlled diabetes.**

How many do you **intend to consider** the impact of periodontal treatment on diabetic control?

Q32.
This question relates to **your next 10 patients with periodontal disease and poorly controlled diabetes.**

How many do you **intend to contact** their doctor with regard to their periodontal disease and poorly controlled diabetes?

Q33. Please use this space to clarify any responses or write any comments, if you would like to.

Appendix 9 Workshop schedule

Workshop Schedule: Healthcare Professional & People with Diabetes.
Study title: Developing oral health initiatives to improve glycaemic control.

Please note: The purpose of this workshop schedule is to have an initial framework of questions with which to work. We will allow the participants to talk freely. This will generate discussion which will enable the workshops to evolve. This will allow us to fully explore the topic, so our emergent findings are not restricted by the initial workshop design.

Workshop Process:

Introduction: The participant is asked if they have read the patient information sheet and whether they have any questions. Any questions are answered and, thus, informed consent is obtained.

Context: To change future clinical practice and enable the delivery of new healthcare interventions, it is understood that knowledge alone is insufficient. Investment potential, on the behalf of the health professionals (HPs) and health system changes are vital. That is why phase 2 of my research is focused on working with HPs and patients with diabetes (PWD); the very people who will deliver and receive healthcare interventions. The expected outcome of the cycles of workshops is to design and develop oral health interventions which will work for PWD and HPs, in the context of their own environment. These interventions will ranked according to implementation potential and subsequently piloted in phase 3 of my fellowship, once ethical approval has been obtained.

Process: During the first round of workshops, HPs and PWD will be separated into two groups. This is to encourage individuals to participate and discuss freely, as it has been observed in the literature that patients can feel inhibited from voicing their opinions when they are in the presence of HPs. In the second round of workshops, the HPs and PWD will be brought together, as all individuals will have grown in confidence and will be more familiar with the topics and process. Finally, modified versions of the oral health interventions will be presented and further refined; and ranked in order of implementation potential. If necessary, further rounds of workshops will be carried out to modify until consensual satisfaction is obtained. This design work will be informed by Normalisation Process Theory (NPT), in order to explore how well the ideas could become embedded into routine practice. NPT offers a theoretical framework with which to optimise the development of a healthcare intervention.

Confidentiality: Participants are reminded that the workshops are recorded, for subsequent transcription, and that they will be anonymised so that their identity will be kept confidential(via the use of a unique participant ID code, able only to be tracked back to your name by members of the research team). They will be reminded about the opportunity to review the transcripts for accuracy if they wish to do so.

Participants are encouraged to relax and reassured that their opinions will be completely respected; as the purpose of the workshop is to observe and learn from the findings of surveys and case studies carried out in phase 1 of this study, examining the management of patients

with diabetes; and to develop, test and refine oral health interventions for these patients. They will be reminded that there are no right or wrong answers.

Topic guide:

1. **Introductions**

Prior to recording, people will introduce themselves:

- Name/what you would like to be called (which will be written on a name card in front of them)
- What is your current clinical role/what is your job/what do you like to do with your time.
- Do you or any one in your family have diabetes? If so how long.
- How aware are you of the evidence about the bidirectional relationship of diabetes and periodontitis?
- *Where applicable:* How and when did you find out about the impact?

2. *Switch on the audio-recorder

3. **Presentation of findings of phase 1, which will lead into a general question and answer session.**

4. **Questions relating to the design of the oral health interventions:**

- Where should the intervention be targeted – primary or secondary care?
- Who is to provide the intervention – GP, PN, DSN, diabetologist?
- Who will be the recipient - all patients with diabetes or poorly controlled patients?
- When should the intervention be targeted – at diagnosis, at review; during a specific conversation?
- What will be the mode of delivery?
- The duration and content?
- How will it be evaluated?
- Who will evaluate it?

Conclusion: As the workshop draws to a close, participants are asked if there is anything they would like to add, to support or clarify what they have said before the recording equipment is turned off. The workshop is terminated and the participants are thanked for their time and their candid responses. Remuneration is made according to professional role or by a gift card for the PWD; and the participants are able to complete travel expense forms. If appropriate, arrangements are made for the next round of workshops; otherwise, the participants are asked if they would like to be sent the findings of the study in the form of a PDF of the published paper or lay report. Those who wish to do so, will have their contact details confirmed.

Appendix 10 Powerpoint slides of oral health interventions

Discuss and refer to a GDP
oral health intervention

1. Change annual diabetes review template on IT system to include

   'when did you last visit your dentist?'

2. Positive response? – fine, go to step 4.
3. No dentist? - **refer to NHS choices** website, insert postcode for nearest NHS practices
4. Inform about links – e.g. brief script:

   "Gum disease is a complication of diabetes, like eye and feet problems etc"

   "Gum disease can affect your glycaemic control"

   "Treatment for gum disease can potentially improve HbA1c by up to 4 mmol/mol"

   & Hand patient a leaflet (Diabetes Research Wellness Foundation)

Discuss and assess periodontitis risk
oral health intervention

Same as 'Discuss and refer to a GDP', but if the patient has not seen a GDP for some time, use these three questions to assess for periodontitis risk.

1. Have you ever been told by a dentist that you have periodontal disease the name for advanced gum disease)?
2. Do you have loose teeth/have you lost teeth because they became loose?
3. Do your gums bleed after brushing your teeth?

Discuss and refer to a DHT team member
oral health intervention

Same as 'Discuss and refer to a GDP', but if the patient has not seen a GDP for some time, refer to a DHT team member for an oral health risk assessment at the medical practice



Appendix 11 Diabetes Research and Wellness Foundation leaflet on periodontal disease and diabetes

Diabetes Research & Wellness Foundation



Periodontal disease and **DIABETES**

By: Professor Philip Preshaw
Specialist in Periodontics
School of Dental Sciences
Newcastle University

What is periodontal disease?

Periodontal disease is the scientific name used to describe gum disease. There are two common forms of periodontal disease. The first is called gingivitis, which is mild inflammation of the gums. The other, more serious, form of gum disease is called periodontitis, in which there is more advanced inflammation of the gums, and the bone that holds the teeth in place begins to be gradually destroyed. If you have diabetes you are more likely to suffer from periodontal disease.

Recognising the symptoms

The most certain way to find out if you have periodontal disease is to visit a dentist. Healthy gums are pink and firm, are tightly attached to the teeth, and don't usually bleed when you brush your teeth (**Figure 1**). Gingivitis develops when the teeth are not brushed effectively. Plaque builds up on the teeth, next to the gum, and the bacteria in plaque cause the gums to become inflamed. As a result, the gums look inflamed and swollen (**Figure 2**), and may bleed when you brush your teeth. Gingivitis is totally reversible, and with good oral hygiene the gums can return to normal.

Periodontitis, the more serious form of gum disease, results from prolonged (over several years) inflammation of the gums as a result of long-term plaque accumulation.

The gum inflammation becomes more and more advanced (**Figure 3**), and the gums start to detach from the tooth. This creates a space between the gum and the tooth called a 'pocket' which is measured by the dentist with a probe. As the pocket gets deeper, the jaw bone holding the teeth in place is gradually destroyed. This process is

1

Figure 1 *Healthy gums are pink and firmly attached to the tooth.*

2

Figure 2 *Gingivitis: inflamed gums that look red and swollen (particularly the part of gum next to the tooth), and may bleed on brushing.*

typically painless, and it progresses very slowly. After many years, so much bone may have been destroyed that the tooth starts to become mobile or loose and gums begin to recede, making the teeth look longer than they used to. This may be the first indication to some patients (who don't regularly visit the dentist) that there is a problem.

How is periodontal disease linked with diabetes?

In the general population, about 10% of all adults suffer from periodontitis. In diabetic populations, a much higher proportion of individuals have periodontitis.

We still don't know the precise reasons why people with diabetes are more likely to suffer from periodontal disease, and this is an ongoing area of research. There are probably several factors which are important, including:

- the immune system may not function properly in people with diabetes, thereby increasing the risk of periodontal disease
- excess lipid tissue (body fat) in obese people with diabetes may produce chemicals which make the gums more likely to become inflamed
- damage to capillaries (the small delicate blood vessels) in the gums may reduce the blood supply to the gums, thereby limiting the actions of defence cells
- wound healing is impaired in diabetes, and therefore, healing in the gums is also reduced

The key thing to remember is that glycaemic control seems to be very important in determining susceptibility to periodontal disease. Previous research has suggested that diabetic individuals with good glycaemic control (HbA1c < 7.0%) did not have any greater risk of periodontal disease than non-diabetic individuals.

3

Figure 3 *Periodontitis: the gums are very inflamed, red and swollen. There is bleeding from the gums, and the gums around the lower teeth are receding.*

4

Figure 4 *Using a single tufted toothbrush to clean an awkward area with slightly overlapping teeth. The brush is cleaning the point where the gum meets the tooth.*

Diagnosis and treatment

If the dentist suspects that you may have periodontal disease, x-rays of your teeth may be taken to check the health of the bone that holds the teeth in place. As with most diseases, prevention is better than a cure. Periodontal disease can generally be prevented by maintaining good oral hygiene (i.e. cleaning your teeth effectively).

Brush your teeth twice per day, for approximately 2-3 minutes each time (which is longer than you think when brushing your teeth!). Be sure to brush every surface of the teeth, and particularly the point where the gum meets the tooth (Figure 4). If your teeth are a little overlapping, or there are awkward areas to clean, then use a small (single tufted) brush. The toothbrush should be positioned so the bristles contact the point where the gum meets the tooth at about a 45 degree angle. Use short back and forth strokes of the brush, with gentle pressure.

A powered brush for most people is as effective as a manual toothbrush. They can also be useful if you have restricted movement. Make sure you clean in between the teeth using floss or a bottle brush (interdental brush) for bigger gaps or if a brace is fitted.

If you have problems with gum disease, it is also recommended to use an antibacterial mouthrinse. Your dentist will be able to advise you on which is best for you, and be sure that it contains fluoride as this will help to protect against tooth decay.

Summing up

It is very important for all people with diabetes to visit a dentist regularly, so that any gum problems can be detected and treated before they become too severe. Your dentist may also clean your teeth for you on a regular basis, or may ask you to see a dental hygienist for cleaning.

People with diabetes are more prone to gum disease, especially if their diabetes is poorly controlled. Good oral hygiene and regular dental check-ups are particularly important in people with diabetes.

Top tips to avoid periodontal disease

- As someone with diabetes you may be more prone to gum problems. See your dentist regularly.
- By keeping good control of your diabetes, and having good blood sugar control, you can reduce the likelihood of gum disease.
- Brush your teeth regularly, being careful to brush every part of the tooth. If this makes the gum bleed, it may be a sign of gum inflammation. If you are concerned about bleeding gums, visit a dentist.
- Even if you no longer have your own teeth, you should still see a dentist periodically to check the health of your mouth.
- If you have had periodontal disease in the past, it is especially important to continue to see the dentist to make sure the disease does not recur.
- Don't smoke. Smoking makes gum disease worse.

More information

For more information on dental health please visit the NHS Choices website at: **www.nhs.uk/livewell/dentalhealth** and the British Dental Health Foundation: **www.dentalhealth.org.uk**

Diabetes Research & Wellness Foundation

www.drwf.org.uk

Registered Office:
DRWF, The Roundhouse, Northney Marina, Hayling Island, Hampshire, PO11 0NH
Tel: 02392 637808
Email : enquiries@drwf.org.uk

Registered Charity No. 1070607
Registered in England, Company Number 3496304
Company Limited by Guarantee

Staying Well Until a Cure is found...

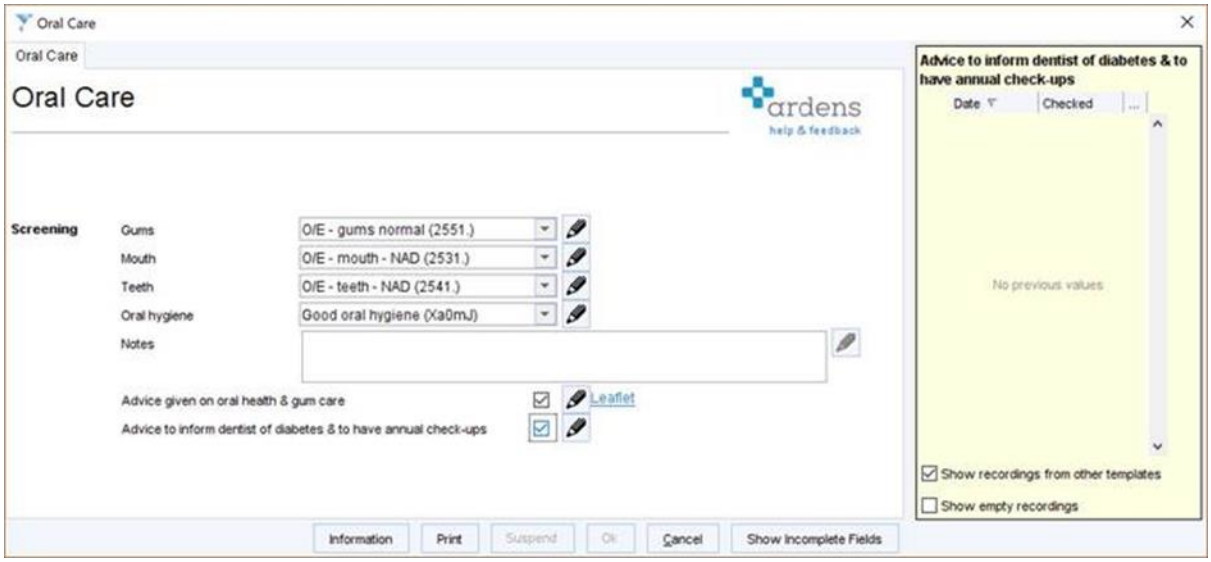
The Diabetes Research & Wellness Foundation works towards educating, informing and reminding you of the best and healthiest choices to make. Contact us to join the Diabetes Wellness Network and request the full series of patient information leaflets.

Health & care information you can trust
The Information Standard Certified Member

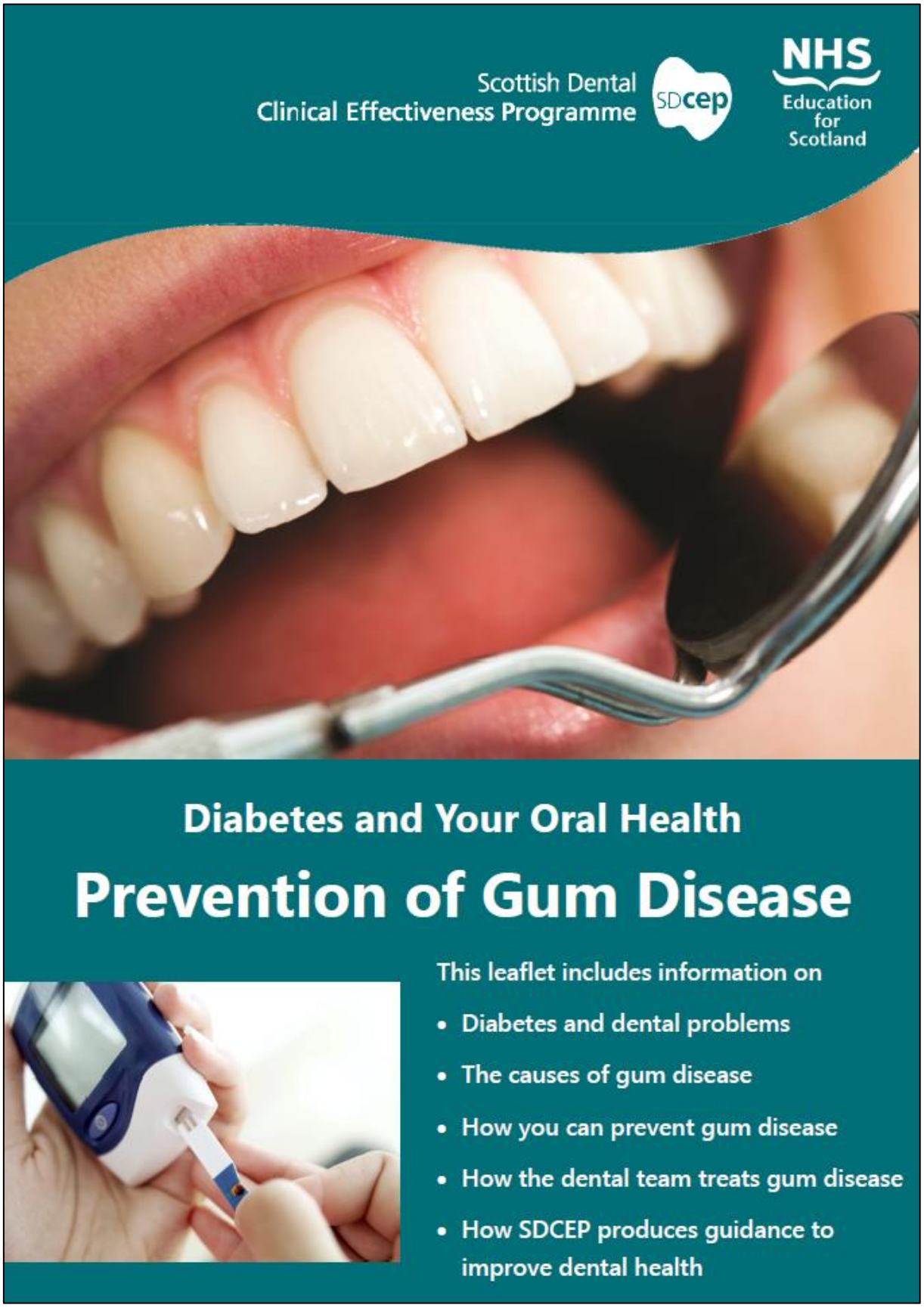
Source references can be provided on request.
All details correct at time of print

V3.0 published: December 2014
Due to be reviewed within 18 months of publication date
Printed by Holbrooks Printers Ltd.
Portsmouth, Hampshire, UK

Appendix 12 Ardens diabetes template oral care section – current version



Appendix 13 Scottish Dental Clinical Effectiveness Programme (SDCEP) leaflet on diabetes and oral health



Why have I been given this leaflet?

One of the complications of diabetes is an increased risk of developing gum disease. Gum disease may also make it more difficult to control your blood glucose. This leaflet explains the ways in which you can reduce your risk of developing diabetes-related gum disease.

What is gum disease?

Gum disease, also known as periodontal disease, is caused by a build up of plaque on the teeth. If plaque is not regularly removed by brushing, the gums can become irritated and inflamed. Plaque which is not removed eventually hardens into a substance called calculus which is also irritating to the gums. Calculus has to be removed by your dentist or hygienist.

Gingivitis

The early stage of gum disease is called gingivitis. The symptoms are swollen, red gums which bleed easily when you brush, floss or eat hard foods, such as apples. You may also notice an unpleasant or metallic taste in your mouth. A relative or friend may complain that you have bad breath. Gingivitis is reversible with good oral hygiene.

Periodontitis

If gingivitis is left untreated, it can develop into a more advanced stage of periodontal disease called periodontitis. If left untreated, periodontitis can lead to receding gums, loose teeth and eventual tooth loss.

Can I prevent gum disease?

Most people with diabetes can prevent gum disease with good oral hygiene. The table lists some key things you can do to improve your oral hygiene and prevent gum disease.

Recommendation 1

Brush your teeth regularly and effectively

Improving your oral hygiene reverses the early stages of gum disease. Your dentist or hygienist can help by showing you how to brush your teeth in the most effective way.

Recommendation 2

Have a plan of when you will brush your teeth

Having a firm plan will help you remember to brush your teeth. For example, you could plan to always brush first thing in the morning when you get up and last thing at night when getting ready for bed.

Recommendation 3

Use an ordinary toothbrush or a rechargeable powered toothbrush and fluoride toothpaste

Rechargeable powered toothbrushes may remove more plaque than ordinary toothbrushes. However, both types of toothbrush are good for removing

What else can I do?

- **Stop smoking**

Stopping smoking reduces your chance of getting gum disease.

- **Clean between your teeth using floss or interdental brushes**

Flossing in addition to toothbrushing may make gums less likely to bleed. Using interdental brushes in addition to toothbrushing may remove even more plaque.

What will the dental team do?

- If you need to improve your oral hygiene, your dentist or hygienist can show you the best ways to remove plaque from your teeth. They can also help you plan when you will do this at home.
- If you have periodontitis, your dentist will show you how to improve your oral hygiene and will recommend that you have treatment to remove the build-up of plaque and calculus on your teeth. You may need intensive treatment that will take place over several weeks.
- If you smoke, your dentist will advise that you consider stopping.
- Your dentist will recommend that you ensure your diabetes is well-controlled, as uncontrolled diabetes increases your risk of developing gum disease.

Why has this leaflet been developed?

SDCEP has recently provided guidance for dental healthcare staff on the best ways to prevent and treat gum disease. SDCEP guidance is developed by groups that contain clinical experts, researchers and patients. This leaflet explains how patients can also make a difference to the health of their gums.

Scottish Dental Clinical Effectiveness Programme
Dundee Dental Education Centre
Frankland Building
Small's Wynd
Dundee DD1 4HN

E-mail: scottishdental.cep@nes.scot.nhs.uk
Phone: 01382 425751
Website: www.sdcep.org.uk

Appendix 14 NICE PH38 diabetes risk score questionnaire guidance (selected pages)

DIABETES RISK SCORE

What is the risk score?

Diabetes UK's Diabetes Risk Score is a questionnaire designed to be completed unaided or with minimal help. However, it can be completed with the aid of Healthcare Professionals. This gives the assessor the opportunity to deliver lifestyle intervention dependent on modifiable risk factors which can increase the value of the questionnaire.

The questionnaire is based on the risk factors of Type 2 diabetes and is designed to determine a person's risk of Type 2 diabetes within the next 10 years. The risk score also identifies those with impaired glucose regulation (IGR) and so at risk of developing Type 2 diabetes.

It was developed by Diabetes UK in conjunction with Leicester University and Leicester University Hospitals using data from 6,390 subjects aged 40–75 from the ADDITION-Leicester screening study in a multi ethnic UK setting (76% White European, 22% South Asian, 3% other). It was developed using logistic regression models for predicting IGR and Type 2 diabetes using data from self-reported questionnaires.

The risk score is not appropriate for pregnant women or those under 18 years of age.

It is based on a points system which, when added together, gives risk and is then classified from low to high.

Everyone who completes the risk assessment will be offered lifestyle intervention advice.

Those at moderate or high risk will be advised to visit their local surgery for a follow-up consultation and possible diabetes diagnosis tests.

DIABETES RISK SCORE

How does the risk score fit with the National Vascular Screening programme? (England only)

The NHS health checks programme aims to screen all people between the age of 40–74 for kidney disease, heart disease and diabetes. In order to determine a person's risk of diabetes the Diabetes Risk Score can be used, potentially limiting the number of people referred on to have diabetes diagnostic tests (lab tests).

Although Diabetes UK risk assessments will feed into the national programme it is important to remember that Diabetes UK is not restricting screening to those between 40–74 years but will be assessing anyone over the age of 18 years old with the exception of pregnant women.

Is the risk score recommended by NICE?

Yes. In the NICE Public Health Guidance document Preventing Type 2 diabetes: risk identification and interventions for individuals at high risk it is recommended as a tool to identify those at risk of developing Type 2 diabetes. You can read the document at:

http://publications.nice.org.uk/preventing-type-2-diabetes-risk-identification-and-interventions-for-individuals-at-high-risk-ph38/recommendations#recommendation-1-risk-assessment

What if a person is shown to be at low or increased risk and has symptoms of diabetes?

Anybody who presents with the symptoms of diabetes should visit their GP as soon as possible regardless of their risk score.

DIABETES RISK SCORE

How to use the questionnaire

The Diabetes UK risk score works on a points based system. Each question has multiple choice answers with different mark allocations. At the end all the points are added up and the score is put into one of the categories of risk.

THE QUESTIONS AND HOW THE SCORE IS ALLOCATED

How old are you?

The older people get the more at risk they are of developing Type 2 diabetes. There is also a link between ethnicity and age, ie if you are white and over 40 or Black, Asian or from another minority ethnic group and over 25 you are at increased risk. In developing the Diabetes Risk Score all risk factors for Type 2 diabetes were looked at and weighted according to a person's overall risk of diabetes, therefore by completing the whole questionnaire the person's complete risk will be assessed.

Are you female or male?

Males have a slightly increased risk of Type 2 diabetes in comparison to females.

What is your ethnic background?

The age and ethnicity link is taken into consideration with the whole risk score rather than being reflected in each of the questions. The weighting that people get in this question affects each of the other questions such as age. For example:

A South Asian woman aged 25 years will receive a lower score for the age question. However, she will be compensated with higher scoring given in the ethnicity question.

A White European woman aged 44 years will receive 0 points for these categories but if she has a higher BMI or waist circumference these risk factors will be taken into consideration with the risk score.

Do you have a father, mother, brother, sister and/or own child with Type 1 or Type 2 diabetes?

Having a blood relative with diabetes increases risk of Type 2 diabetes. The closer the relative the greater the risk.

DIABETES RISK SCORE

Measure the person's waist circumference

The larger your waist circumference is, the higher your risk. A person's waist measurement is scored according to the category it comes into. The bigger their waist, the higher their score will be.

Calculate the person's Body Mass Index (BMI)

The larger the person, the higher their chance is of developing impaired glucose regulation (IGR) and/or Type 2 diabetes. BMI is used for this classification. In order to calculate a person's BMI you need to measure their height and weight.

Have you been given medicine for high blood pressure or told that you have high blood pressure by your doctor?

High blood pressure can also be referred to as hypertension or a person being hypertensive. High blood pressure increases the risk of Type 2 diabetes. If a person does not know if they have had high blood pressure before or if they are taking blood pressure medication then the answer would be 'no'.

ONCE THE SCORE IS OBTAINED

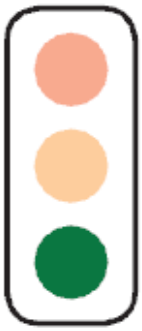
When the scores are added up use the What your risk score means information sheets provided as part of this pack to explain the result to the person.

Those with 'moderate' and 'high' risk will require a GP referral letter, provided as part of this pack.

Offer everyone the healthy eating and physical activity information sheets.

DIABETES RISK SCORE

What the score means



GREEN (LOW RISK)

- You scored _____ points.
- **LOW** risk of developing Type 2 Diabetes.
- **1 in 20** chance that you will develop Type 2 Diabetes in the next ten years.

Let's take a look at where you scored and what this means.

Not a diagnosis

The assessment identifies the risk of developing Type 2 diabetes.

Factors

Go through the factors which contributed to the person's score. Explain why.

i.e. "so you scored 5 points because of your BMI. The more overweight you are the higher your risk becomes, however by losing just 10% of your body weight you will reduce your risk"

REMEMBER

Non modifiable risk factors
e.g. Ethnicity, gender, family history. They can't change/influence these factors. They just need to be aware these increase their risk

Potentially modifiable risk factors
e.g. BMI, waist circumference. They can have influence over these factors. If they don't score highly here – lifestyle change isn't applicable.

In the future

Remind them – as they get older and if their weight/waist circumference increases, their risk will increase.

DIABETES RISK SCORE

FLASHING AMBER (INCREASED RISK)

- You scored _____ points.
- **INCREASED** risk of developing Type 2 Diabetes.
- **1 in 10** chance that you will develop Type 2 Diabetes in the next ten years.

Let's take a look at where you scored and what this means.

Not a diagnosis

The assessment identifies the risk of developing Type 2 diabetes.

Factors

Go through the factors which contributed to the person's score. Explain why.

i.e. "so you scored 5 points because of your BMI. The more overweight you are the higher your risk becomes, however by losing just 10% of your body weight you will reduce your risk"

REMEMBER

Non modifiable risk factors
e.g. Ethnicity, gender, family history. They can't change/influence these factors. They just need to be aware these increase their risk

Potentially modifiable risk factors
e.g. BMI, waist circumference. They can have influence over these factors. If they don't score highly here – lifestyle change isn't applicable.

In the future

Remind them – as they get older and if their weight/waist circumference increases, their risk will increase.

DIABETES RISK SCORE

AMBER (MODERATE)

- You scored _____ points.
- **MODERATE** risk of developing Type 2 Diabetes.
- **1 in 7** chance that you will develop Type 2 Diabetes in the next ten years.

Let's take a look at where you scored and what this means.

Not a diagnosis

The assessment identifies the risk of developing Type 2 diabetes.

Tell them they need to go to their GP surgery to discuss their risk of Type 2 diabetes.

FILL IN THE GP LETTER AND GIVE IT TO THEM

Factors

Go through the factors which contributed to the person's score. Explain why.

i.e. "so you scored 5 points because of your BMI. The more overweight you are the higher your risk becomes, however by losing just 10% of your body weight you will reduce your risk"

REMEMBER

Non modifiable risk factors
e.g. Ethnicity, gender, family history. They can't change/influence these factors. They just need to be aware these increase their risk.

Potentially modifiable risk factors
e.g. BMI, waist circumference. They can have influence over these factors. If they don't score highly here – lifestyle change isn't applicable.

Ignorance is not bliss

With Type 2 diabetes, **the sooner you know** whether or not you have the condition, **the sooner it can be treated.** If it is left untreated it can lead to serious complications, e.g. blindness, heart attack, stroke, kidney failure or amputation.

DIABETES RISK SCORE

RED (HIGH)

- You scored _____ points.
- **HIGH** risk of developing Type 2 Diabetes.
- **1 in 3** chance that you will develop Type 2 Diabetes in the next ten years.

Let's take a look at where you scored and what this means.

Not a diagnosis

The assessment identifies the risk of developing Type 2 diabetes.

Tell them they need to go to their GP surgery to discuss their risk of Type 2 diabetes.

FILL IN THE GP LETTER AND GIVE IT TO THEM

Factors

Go through the factors which contributed to the person's score. Explain why.

i.e. "so you scored 5 points because of your BMI. The more overweight you are the higher your risk becomes, however by losing just 10% of your body weight you will reduce your risk"

REMEMBER

Non modifiable risk factors
e.g. Ethnicity, gender, family history. They can't change/influence these factors. They just need to be aware these increase their risk.

Potentially modifiable risk factors
e.g. BMI, waist circumference. They can have influence over these factors. If they don't score highly here – lifestyle change isn't applicable.

Ignorance is not bliss

With Type 2 diabetes, the **sooner you know** whether or not you have the condition, **the sooner it can be treated**. If it is left untreated it can lead to serious complications, e.g. blindness, heart attack, stroke, kidney failure or amputation.

Appendix 15 ***British Dental Journal*** **paper accepted for publication**

Uptake of best practice recommendations in the management of patients with diabetes and periodontitis: a cross-sectional survey of dental clinicians

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[2] Assistant Professor, University of Ottawa, and Scientist, Centre for Implementation Research, Ottawa Hospital Research Institute, Ottawa, Canada

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Keywords: Periodontitis; diabetes; clinical behaviours; best practice

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ABSTRACT

Introduction: Published guidance documents describe best practice recommendations for management of patients with diabetes and periodontitis. However, little is known about their uptake by dental professionals.

Aims: To explore current practice and behavioural correlates for three behaviours in the management of patients with diabetes and periodontitis: *informing* patients about the links; *considering* the impact of periodontitis treatment on glycaemic control; and *contacting* the patient's doctor.

Methods: Participants (n=328) recruited via two UK professional dental societies completed online questionnaires assessing their *informing*, *considering* and *contacting* activities, utilising constructs from behavioural and implementation theories (social cognitive theory and normalization process theory).

Results: There was good reported uptake of *informing* and *considering*, with clinicians performing these behaviours in >8 of their last 10 patients. However, there was poor uptake of *contacting*. Periodontal specialists had significantly higher scores for *contacting* (3.44±4.16 of last 10 patients) than dental hygienist/therapists (0.57±1.37, $p<0.001$), who mainly relied on dentists to contact the doctor. Respondents indicated negative experiences of *contacting*, preferring to communicate via the patient than contact the doctor directly.

Conclusion: Contacting the doctor can be problematic and dental clinicians generally chose not to do this, indicating a mismatch between this best practice recommendation and preferences of dental clinicians.

IN BRIEF

1. Dental clinicians usually inform their patients with diabetes and periodontitis about the links between the two diseases, and consider the impact of periodontitis treatment on glycaemic control.

2. Dental clinicians tend not to contact the doctor about the patient's diabetes, and when they do, they mostly prefer to communicate through the patient as opposed to contacting the doctor directly, despite published guidance recommendations.

3. Despite difficulty with (and previous negative experiences of) contacting the doctor, dental clinicians would endeavour to do so if they felt it necessary, but they choose not to, which reveals a potential mismatch between this best practice recommendation and the communication practices of dental clinicians.

INTRODUCTION

People with poorly controlled diabetes have a three-fold increased risk of developing periodontitis, which, in turn, can negatively impact glycaemic control.[1] Furthermore, treatment of periodontitis can result in improved glycated haemoglobin (HbA1c) levels, the reduction being similar to that expected from second line diabetes medication.[2, 3] Previous qualitative research exploring the management of periodontitis within the context of diabetes suggests that whereas these facts may be well known to dental professionals, people with diabetes and medical professionals are frequently unaware.[4]

In 2013, the findings of a workshop held by the European Federation of Periodontology (EFP) and American Academy of Periodontology (AAP) on the links between periodontal diseases and general health were published, together with a manifesto on this topic.[5] The evidence-based papers that were published called for closer collaboration between dental and medical clinicians to improve patient care, with a clear emphasis on informing and educating patients about the links between periodontitis and diabetes. For example, they recommended that patients newly diagnosed with diabetes should receive a periodontal examination, and that patients who do not currently have diabetes but present in the dental clinic with risk factors for diabetes and signs of periodontitis should be informed about their risk for having diabetes, assessed using a chairside HbA1c test, and/or referred to a physician for appropriate diagnostic testing.[6] In the UK, guidance documents on this topic include the British Society of Periodontology (BSP) Good Practitioners Guide, which suggests contacting the patient's doctor to obtain recent HbA1c test results to help the dental team better understand the diabetes risk to periodontal health.[7] Similarly, the UK Department of Health recommended that the dental team write to the patient's doctor for information on the patient's diabetes status (particularly HbA1c levels), and produced a template letter for dental clinicians to use in this regard.[8] To date, little is known about the uptake of these recommendations by dental professionals.

AIMS

We aimed to investigate the reported practices of dental clinicians in relation to management of patients with periodontitis and diabetes to ascertain whether published best practice recommendations[6-8] were being followed and to assess the factors which predict behaviour. We focussed on three recommended clinical behaviours:

1. *Informing* patients with diabetes about the links between diabetes and periodontitis;

2. *Considering* the impact of periodontitis treatment on the patient's glycaemic control, as opposed to treating periodontitis in isolation from the diabetes;

3. *Contacting* the doctor with regard to the management of patients who have periodontitis and poorly controlled diabetes.

MATERIALS AND METHODS

Design

The study used a cross-sectional design, involving online questionnaires (Qualtrics) to collect clinicians' self-reported performance and views on the three clinical behaviours. The questionnaire was piloted prior to use with dental clinicians. In accordance with the UK Medical Research Council guidance for developing and evaluating complex interventions,[9] we used theory to explore dental professionals' behaviours in the management of patients with periodontitis and diabetes, specifically a combination of Social Cognitive Theory (SCT)[10, 11] and Normalisation Process Theory (NPT) (Table 1).[12]

SCT is a theory of motivation and action that describes key modifiable cognitions that can help to explain and improve the quality of care.[13-15] SCT posits that the care that clinicians provide is a function of their belief in their ability to do so (self-efficacy), their beliefs about the consequences of the care they provide (outcome expectations), their intention to do so (proximal goals) and the external social and structural factors that act as barriers and enablers (socio-structural determinants). NPT is an implementation theory used to identify, conceptualise and evaluate the factors that promote or inhibit the introduction, implementation and embedding of processes (such as patient management) into normal care.[16, 17] For researchers who wish to utilise NPT, the NoMAD instrument[12, 18] was developed as a tool to quantitatively assess implementation determinants, and is composed of four core constructs: coherence, cognitive participation, collective action, reflexive monitoring and 16 sub-constructs or items. The authors suggested customisation of the NoMAD tool by selecting sub-constructs as appropriate according to the study context (Table 1).

The questionnaire assessed the following parameters:

Self-reported past behaviour. The questionnaire measured past behaviour in terms of the last 10 patients with diabetes seen for whom the clinicians reported performing any of the three recommended clinical behaviours (*informing, considering, contacting*). Response options ranged from 0 to 10 patients (i.e. the behaviour was performed on '*x*' of their last 10 patients with diabetes), with this approach chosen as a means to simplify the estimation of the behaviour by the participant. The wording and operationalization of this measure was consistent with other studies of clinicians' provision of diabetes-related healthcare.[19]

SCT constructs. For each of the three recommended clinical behaviours, Proximal Goals was assessed on a 10-point scale of direct estimation of how many of their next 10 patients with diabetes they intended to engage in each behaviour. Self-efficacy and Outcome Expectations were also assessed for each behaviour, using a 5-point Likert scale with response options: '1-strongly disagree', '2-disagree', '3-neither agree or disagree', '4-agree', and '5-strongly agree'). Items assessing SCT constructs were worded in a manner consistent with past research.[19]

NPT constructs. In customising the NoMAD tool, five NPT sub-constructs were measured: differentiation; communal specification; individual specification; internalisation; legitimation[12]; and these were measured using a 5-point Likert scale (same scale as above). Multiple item questions were informed by previous qualitative exploration of the determinants involved in carrying out behaviours in the context of diabetes and periodontitis.[4]

Finally, a free-text box enabled respondents to provide any further comments for qualitative analysis.

Study population

Participants invited to complete the questionnaire included dental clinical academics, periodontal specialists, general dental practitioners (GDPs) and dental hygienist/therapists (DHTs) working in academia, primary and secondary care services. They were recruited via two professional societies, the British Society of Periodontology (BSP) and British Society of Dental Hygiene and Therapy (BSDHT). These societies were selected to optimise recruitment as it was considered likely that their members would be interested in the subject area. Based on systematic reviews of predictive healthcare professional behaviour regression modelling, a sample size target of n=150 completed questionnaires was set.[20, 21]

A link to the questionnaire was emailed to each member of the two societies (combined membership of approximately 4,000: BSP ~1,000 and BSDHT ~3,000). The recruitment period ran from January to May 2016 with repeat mailings to encourage participation. No attempts were made to achieve targets with respect to numbers of responses from specific groups of clinicians as this was not considered feasible within the study design. Completion and submission of the questionnaire was incentivised via a prize draw to win one of ten £100 Amazon gift cards. The questionnaires were completed anonymously, however in order to issue prizes, the respondents were invited to provide their General Dental Council (GDC) registration number to be entered into the prize draw.

Statistical analysis

Statistical analysis was conducted using SPSS v23.0 for Windows. Descriptive analyses (means and standard deviations) were calculated to summarise sample characteristics and NPT data. Constructs that were multi-item were tested for internal consistency in order to combine results to a single mean score.[22, 23] To explore variation in responses according to professional role, Kruskal Wallis tests were used to identify significant differences between three professional groups (periodontal specialists, GDPs, and DHTs), with Mann Whitney tests for post-hoc comparisons with adjustment of the critical value of *p* as appropriate. SCT correlates of behaviour were assessed using binary univariate and multivariate logistic regression to identify construct predictors for each of the behaviours.

Ethical Approval

A favourable ethical opinion was obtained from North West-Greater Manchester West Research Ethics Committee (16/NW/0030).

RESULTS

346 questionnaires were returned in total: 103 from BSP members (~10% response rate); and 243 from BSDHT members (~8% response rate). Partially completed questionnaires were deleted list-wise to achieve a final sample of 328: 42 periodontal specialists, 13 GDPs, and 273 DHTs (including individuals who were members of BSDHT or BSP). The majority of the participants were female (84%).

Sample sociodemographic and clinical practice descriptive statistics (Table 2) show that DHTs reported seeing, on average, approximately twice the number of patients with diabetes per month (21) compared to specialists (10). GDPs reported spending the least amount of time practising periodontology (though the questionnaire did not ascertain precisely which types of periodontal treatments they were providing), however this was still a large percentage of their time (43%). For those respondents working in primary care, a small amount of periodontal treatment was reported to be provided under NHS contracts (16%), with the majority being treated privately (57%) or by some other non-NHS payment scheme (27%).

Behaviour 1: Informing patients with diabetes about the links between diabetes and periodontitis

The questionnaire identified that dental clinicians reported *informing* more than nine out of their last 10 patients with diabetes about the links between diabetes and periodontitis. These scores were consistent with high scores for outcome expectations, proximal goals, internalisation and legitimation (Table 3). Significant differences were seen however, between the responses of the specialists and DHTs for self-efficacy (3.75±1.24 and 3.32±1.07) (p=0.01), differentiation (1.87±1.00 and 2.44±1.23) (p=0.01); and specification, both communal (4.10±1.10 and 3.68±1.13) (p=0.01) and individual (4.21±1.06 and 3.86±1.05) (p=0.01).

The SCT predictors for *informing* accounted for a medium amount of variance (Cox & Snell R^2 0.14; Nagelkerke R^2 0.24), with outcome expectations (B=2.44, p<0.001) and proximal goals (B=5.01, p<0.001) as significant predictors of informing (Table 4). Self-efficacy was not statistically significant (B=1.32, p=0.13) when it was included in a model that controlled for demographic factors and included other SCT constructs.

The qualitative responses regarding *informing* patients about the links between diabetes and periodontitis were consistent with the quantitative findings, suggesting that all professional groups are performing this behaviour with almost all of their patients with diabetes. Some professionals noted:

> Patients who aren't diagnosed with diabetes should also be informed of the link between diabetes and periodontitis. I inform all patients with periodontitis. (Specialist Periodontist)

As periodontitis is a risk factor for diabetes, they inform all of their patients with periodontitis about the links.

Behaviour 2: Considering the impact of periodontitis treatment on glycaemic control.

All dental professional groups reported high uptake (self-reported past behaviour) of *considering* the impact of periodontitis treatment on diabetes control, with mean scores showing that the clinicians considered this element of care for more than eight of their last 10 patients with diabetes. These scores were consistent across SCT constructs with high scores for outcome expectations, proximal goals, internalisation and legitimation (Table 3); and, although not as high, the scores for self-efficacy and specification, both communal and individual, were positive. There were, however, significant differences seen between the responses of the specialists and DHTs for differentiation (2.23±1.20 and 2.93±1.25) ($p<0.001$).

The SCT predictors for *considering* accounted for a medium amount of variance (Cox & Snell R^2 0.11; Nagelkerke R^2 0.15), with all three SCT constructs as statistically significant predictors (Table 4). Outcome expectations ($B=1.79$, $p<0.001$) was the strongest predictor, followed by self-efficacy ($B=1.44$, $p<0.01$).

The qualitative responses for *considering* the impact of periodontitis treatment on glycaemic control showed that some DHTs reported checking the patient's glycaemic control infrequently:

> I have always considered the impact of diabetes on periodontitis and treatment. But never the impact of periodontal treatment on diabetes control. (DHT)

Instead, they focused on updating the patient's medical/medication history at successive appointments.

Behaviour 3: Contacting the patient's doctor with regard to their poorly controlled diabetes

All three dental professional groups reported low uptake of *contacting* the patient's doctor with regard to patients' periodontitis and poorly controlled diabetes, with a score of 3.44±4.16 for the specialists, which was (non-significantly) higher than that of GDPs (0.75±1.06), and

significantly higher than that of DHTs (0.57±1.37) ($p<0.001$). These results were consistent across SCT constructs, with low responses for proximal goals, and mid-scale responses for outcome expectations (Table 3). Mean scores for self-efficacy were similar for specialists (3.65±1.16) and GDPs (3.01±0.75), but significantly different between specialists and DHTs (2.83±0.89) ($p<0.001$). Significant differences between specialists and DHTs were also identified in the responses to NPT items, apart from internalisation which nonetheless revealed positive responses across all professional groups.

The SCT predictors for *contacting* accounted for a medium amount of variance (Cox & Snell R^2 0.20; and Nagelkerke R^2 0.29), with both outcome expectations ($B=1.72$, $p<0.001$) and proximal goals ($B=1.14$, $p<0.001$) as statistically significant predictors (Table 4). Self-efficacy was not statistically significant when it was included in a model that controlled for demographic factors and included other SCT constructs.

The qualitative responses to *contacting* the patient's doctor with regard to patient's poorly controlled diabetes were mainly negative, which was consistent with the quantitative findings (that indicated very low uptake of the behaviour). There were comments from all professional groups regarding the difficulty of getting a response from a letter to a patient's doctor; and many had experienced negative encounters with doctors. Several DHTs stated that their practice preferred the referring dentist to contact the patient's doctor, with the exception of those DHTs seeing patients under direct access arrangements.

> I personally would not inform the doctor when a patient has these problems as the dentist would do it, being head of the dental team. However, if I were seeing a patient under direct access then it would be my responsibility. (DHT)

Many respondents preferred to communicate through the patient, for instance by asking a patient with periodontitis to go to the doctor in the case of suspecting undiagnosed diabetes; or with regard to glycaemic control, even with concerns regarding the accuracy of patient report:

> I often suggest seeing [the] GP if [the] periodontal treatment response is poor when I am not expecting it to be - for a diabetes check - to rule it out. If I felt that it was needed then I would be happy to contact the GP regardless of time etc - I would want to provide the best I could for my patient. (DHT)

DISCUSSION

Given the increasing strength of evidence linking periodontitis and diabetes, and the known benefits of periodontitis treatment on diabetes control, it is unsurprising that many scientific and professional organisations have published recommendations for clinical practice, and that these evolve over time. Indeed, most recently, the consensus report of a joint workshop held by the EFP and the International Diabetes Federation has been published.[24] This included updates on epidemiological studies of the effect of periodontitis on diabetes,[25] the pathogenic mechanisms linking the two diseases,[26] and the impact of periodontal therapy on glycaemic control.[3] Importantly, this workshop was inter-professional and the papers were published simultaneously in both a dental journal (*Journal of Clinical Periodontology*) and a medical journal (*Diabetes Research and Clinical Practice*) to help to improve awareness of this topic among dental and medical clinicians. The consensus report included guidelines for medical professionals (such as informing patients with diabetes about their risk for periodontitis and investigating the presence of periodontal disease as an integral component of diabetes care), guidelines for patients, and guidelines for dental professionals (including asking patients about their most recent HbA1c results, as well as suggesting that patients who do not currently have a diagnosis of diabetes but present in the dental practice with diabetes risk factors should be informed about their risk for having diabetes, and referred to a doctor).[24]

In this cross-sectional survey, we investigated the quantitative and qualitative self-reports of periodontal specialists, GDPs and DHTs for three extant best practice clinical behaviours in the context of diabetes and periodontitis care published at the time of our research.[6-8] These included *informing* patients about the links between periodontitis and diabetes, *considering* the impact of periodontitis treatment on the patient's glycaemic control (rather than treating periodontitis in isolation from the diabetes), and *contacting* the patient's doctor with regard to their periodontitis and poorly controlled diabetes. The research did not aim to suggest what different professional groups *should* be doing in relation to these topic areas, but rather aimed to identify current practice as reported by clinicians themselves, and to identify modifiable correlates while positioning these in the context of published guidance. To the best of our knowledge, this is the first time that these two theories (SCT and NPT) have been utilised together.

The findings suggest that overall, if a patient with periodontitis and poorly controlled diabetes goes to a dental professional, it is likely that they will be *informed* about the links between the diseases. There was high reported uptake of this behaviour by all three professional groups,

with participants reporting informing more than nine out of their last 10 patients with diabetes about the links. Patients who have periodontitis but not diabetes may also sometimes be informed about the links, particularly if undiagnosed diabetes is suspected, as was suggested by some specialists. There were significant differences between responses of specialists and DHTs for self-efficacy, communal and individual specification, and legitimacy for *informing*, indicating that not all dental clinicians have the same understanding of how *informing* affects their work or consider it normal practice.

Most clinicians reported that they generally *consider* the impact of periodontitis treatment on the patient's glycaemic control, with participants in all three professional groups reporting that they considered the impact of periodontitis treatment in more than 8 out of their last 10 patients with diabetes and periodontitis. This suggests that evidence confirming the beneficial impact of periodontitis treatment on glycaemic control[2, 3] is known to dental professionals, though it should also be noted that some clinicians (notably DHTs) further reported that whereas they acknowledge the effect that diabetes has on periodontitis, they do not always tend to consider the effect of periodontitis treatment on diabetes.

The findings for *contacting* the patient's doctor with respect to patients' periodontitis and poorly controlled diabetes showed consistently low levels of reported past behaviour across all professional groups, and this behaviour would appear more likely to be carried out by a specialist than a DHT or GDP. However, specialist's motivation (proximal goals) appears to be low for contacting the patient's doctor in the future, similar to those of DHTs and GDPs, despite the published best practice recommendations.

The qualitative findings showed that many clinicians prefer to communicate through the patient rather than directly contacting the patient's doctor, despite questions of reliability. The reasons for this were varied: they were not aware of the recommendations; a perception that it empowers the patient; patient preference; difficulties in getting a response from the doctor, either by letter or by telephone; and reports of previous negative experiences of interactions with doctors or diabetes nurse specialists. Divisions between dental and medical professionals have been shown in previous research[4] and it is not uncommon for clinicians to be unaware of guidelines and instead operate by 'mindlines', which are collectively reinforced, internalised guidelines informed mainly by their own experiences and those of colleagues, and their interactions with each other, patients and opinion leaders.[27]

The specialists had significantly higher self-efficacy scores than DHTs for *contacting*, which was consistent with some DHT's comments that it wasn't expected of them to contact the patient's doctor. The responses of the specialists were also significantly different to those of DHTs for the NPT sub-constructs of differentiation, specification and legitimation, which was consistent with the qualitative findings that suggested some DHTs do not see this as part of their job role, perhaps due to practice policies which rely on the referring or principal dentist to contact the doctor. Nonetheless, the DHT responses for internalisation or seeing the potential value of contacting were relatively high and some commented that they would consider a peer review session or practice meeting to review the policy, especially with regard to direct access.[28] SCT and NPT responses suggest that should an educational intervention or training to increase the uptake of this behaviour be considered worthwhile, the intervention should focus on outcome expectations, proximal goals and communal specification. Such an intervention could particularly benefit DHTs who see a higher number of patients with diabetes compared to other dental clinicians; and although not a significant predictor, perhaps self-efficacy would help with motivation, particularly for DHTs.

Study limitations

Self-report completion of the questionnaires was a direct way of gathering data; however, self-reporting one's behaviour is inherently affected by recall bias and social desirability bias.[29] We recruited participants via the membership of two professional societies affiliated with periodontology to optimise the response rate of interested participants; however, the population ratio of professional groups was heavily swayed towards DHTs (83%). Given the design of the study, which required interested individuals to respond to the invitation to complete the questionnaire, it was not feasible to set targets for responses from specific clinician groups. The imbalance in response rates between the three groups coupled with the low response from GDPs were limitations that can be appreciated particularly when considering the sub-group analyses. GDPs reported spending an average of 43% of their time practising periodontology, which may reflect the specialist interest in the responding GDPs. This recruitment strategy meant that the opinions of GDPs who are not as interested in periodontology were under-represented in this sample. Furthermore, it is not known specifically what was meant by the GDPs in their reporting of spending 43% of their time practising periodontology, i.e. whether this referred to treatment of periodontitis, which would be highly relevant in the context of managing patients with diabetes, or whether this also

includes treatment of gingivitis and prevention (e.g. by delivery of oral hygiene instruction). As the questionnaire was cross-sectional, the dependent variable in the logistic regression analysis was self-reported past behaviour, used as a proxy for future behaviour.[14] Longitudinal designs using self-report and including objective measures of clinical behaviour would be relevant for future research.

CONCLUSIONS

The self-reported responses for *informing* about the links and *considering* the impact of periodontitis treatment on glycaemic control show that there is good uptake of these behaviours by dental professionals. This suggests that best practice guidance documents and scientific evidence on the links between diabetes and periodontitis and the beneficial impact of periodontitis treatment on glycaemic control are known to dental professionals who are acting in accordance with recommendations. However, we have identified that dental professionals *contacting* the patient's doctor with regard to patients' periodontitis and poorly controlled diabetes is not reported as happening to any great extent, with specialists only reporting this behaviour in a minority of their patients with diabetes, and GDPs and DHTs reporting this behaviour in less than 1 of their last 10 patients. Furthermore, the low uptake of this behaviour and preference to communicate through the patient (despite reliability issues) seem to raise a question regarding the relevance of this best practice recommendation that is featured in several guidance documents. These findings were consistent across all three professional groups and despite difficulty with (and previous negative experiences of) contacting the doctor, dental clinicians would endeavour to do so if they felt it necessary, but they chose not to, which reveals a potential mismatch between this best practice recommendation and the communication preferences of these front-line dental clinicians. If adherence to these recommendations is felt to be important to the overall aim of improving communication between medical and dental professionals to optimise patient care, then interventions to improve uptake could including aiming to increase outcome expectations and proximal goals/motivation. Furthermore, before recommending particular behaviours in published guidance documents, we consider that policy-makers and scientific/professional organisations should develop recommendations and test the feasibility of their implementation in close concert with the patient and professional groups concerned.

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Table 1 Definitions of Social Cognitive Theory (SCT) and Normalisation Process Theory (NPT) constructs utilised in this research

Social Cognitive Theory (SCT): a theory of motivation and action that is used to predict clinicians' cognitions that may improve quality of care. SCT comprises 3 constructs:		
	Self-efficacy	The belief in one's ability to succeed in specific situations or accomplish a task.
	Outcome Expectations	One's expectations about the consequences of performing an action or behaviour.
	Proximal Goals	One's intention (i.e. motivation) that regulates future effort and action with respect to a particular behaviour.
Normalisation Process Theory (NPT): a framework that is used to evaluate the factors that promote or inhibit implementation of processes (such as specific aspects of patient management) into routine care. NPT comprises 4 core constructs:		
	Coherence	How clinicians make sense of the behaviour or intervention, e.g. what it involves and why?
	Cognitive Participation	How clinicians get involved and stay committed, e.g. can they see how they contribute?
	Collective Action	How clinicians make it work in practice, e.g. what do they need to make it happen?
	Reflexive Monitoring	How clinicians assess whether it is worth the effort, e.g. does it result in benefits to patient care?
NPT also includes up to 16 sub-constructs, and those that are relevant to the particular clinical scenario should be selected. We selected 5 NPT sub-constructs in this research, and the participants were asked to respond to these in the questionnaire:		
	Differentiation	I can see how the (behaviour) differs from usual ways of working.
	Communal specification	Staff in this organisation have a shared understanding of the purpose of this (behaviour).
	Individual specification	I understand how the (behaviour) affects the nature of my own work.
	Internalisation	I can see the potential value of the (behaviour) for my work.
	Legitimation	I believe that participating in the (behaviour) is a legitimate part of my role.

Table adapted from Bandura (SCT),[10, 11] May *et al*,[12] and Finch *et al* (NPT).[18]

Table 2 Sample characteristics of study population (n=328)

Sex (N, %)	Female	274 (84.3%)
	Male	54 (15.7%)
Age cohort (N, %)	< 30 years	41 (12.5%)
	30-40 years	85 (25.9%)
	40-50 years	89 (27.1%)
	50-60 years	94 (28.7%)
	> 60 years	19 (5.8%)
Sample recruitment (N, %)	BSP	90 (27.4%)
	BSDHT	238 (72.6%)
Years since first registered with GDC		19.78 ± 11.82
N patients with diabetes seen per month	Specialists (n=42)	10.16 ± 9.83
	GDPs (n=13)	14.62 ± 12.43
	DHTs (n=273)	21.29 ± 23.74
% of clinical time spent in practise of periodontology:	Specialists (n=42)	66.83% ± 33.42%
	GDPs (n=13)	43.08% ± 25.29%
	DHTs (n=273)	71.12% ± 28.35%

Data for continuous variables presented as mean ± standard deviation.
BSP, British Society of Periodontology; BSDHT, British Society of Dental Hygiene and Therapy; GDPs, general dental practitioners; DHTs, dental hygienists and therapists.

Table 3 Descriptive statistics of the three behaviours for SCT and NPT

Behaviour	Professional role	Past behaviour	Self-efficacy	Outcome expectations	Proximal goals	Differentiation	Communal specification	Individual specification	Internalisation	Legitimation
Informing	Sp. (n=42)	9.83±0.54	3.75±1.24	4.54±0.55	9.95±0.31	1.87±1.00	4.10±1.10	4.21±1.06	4.82±0.39	4.90±0.31
	GDP (n=13)	9.31±2.21	3.96±0.84	4.19±0.60	10.00±0.00	2.62±1.39	3.62±1.04	4.15±1.07	4.62±0.51	4.85±0.38
	DHT (n=273)	9.34±1.87	3.32±1.07	4.40±0.65	9.90±0.62	2.44±1.23	3.68±1.13	3.86±1.05	4.65±0.52	4.74±0.48
	p	0.60	**0.01 (Sp. vs DHT 0.01)**	0.15	0.77	**0.01 (Sp. vs DHT 0.01)**	**0.02 (Sp. vs DHT 0.01)**	**0.02 (Sp. vs DHT 0.01)**	0.10	0.07
Considering	Sp. (n=42)	8.56± 2.80	3.88±1.18	4.32±0.79	9.66±1.49	2.23±1.20	3.82±1.14	4.21±0.98	4.46±0.85	4.54±0.82
	GDP (n=13)	8.46±2.82	4.07±0.69	4.42±0.45	9.62±1.39	2.54±1.20	3.23±1.17	4.15±0.80	4.62±0.51	4.77±0.44
	DHT (n=273)	8.21±2.93	3.57±1.03	4.33±0.72	9.71±1.42	2.93±1.25	3.65±1.12	3.94±1.04	4.47±0.64	4.61±0.59
	p	0.55	0.04	0.99	0.86	**<0.001 (Sp. vs DHT <0.001)**	0.13	0.22	0.72	0.67
Contacting	Sp. (n=42)	3.44±4.16	3.65±1.16	3.73±0.99	5.46±4.30	2.97±1.25	3.46±0.94	3.97±0.84	4.08±0.96	4.03±0.87
	GDP (n=13)	0.75±1.06	3.01±0.75	3.19±1.11	5.85±3.91	3.46±0.97	2.69±1.03	3.69±0.86	4.08±0.64	3.77±0.73
	DHT (n=273)	0.57±1.37	2.83±0.89	3.28±0.99	4.49±4.28	4.00±0.99	3.01±1.16	3.64±0.86	3.88±0.87	3.61±0.96
	p	**<0.001 (Sp. vs DHT <0.001)**	**<0.001 (Sp. vs DHT <0.001)**	0.44	0.14	**<0.001 (Sp. vs DHT <0.001)**	**0.01 (Sp. vs DHT 0.01)**	**0.05 (Sp. vs DHT 0.01)**	0.25	**0.03 (Sp. vs DHT 0.01)**

Past behaviour and proximal goals were 10-point scales, i.e. for how many of the last 10 patients did the clinician perform the behaviour ('past behaviour'), and for how many of their next 10 patients does the clinician plan to perform the behaviour ('proximal goals'); the other measures were 5-point Likert scales: 1-strongly disagree', '2-disagree', '3-neither agree or disagree', '4-agree', and '5-strongly agree'.
Data presented as mean ± standard deviation.
p = test of differences between professional groups determined using Kruskal-Wallis (with post-hoc Mann Whitney tests and adjustment of critical value of p). GDP, general dental practitioners; DHT, dental hygienists and therapists; Sp, specialists; SCT, social cognitive theory; NPT, normalisation process theory. Statistically significant differences are indicated in bold font.

Table 4 Multivariate logistic regression model predicting past informing, considering and contacting (n=328)

Behaviours	Covariates and SCT Predictors	B	SE	p	95% CI B Coefficient	
					Lower	Upper
Informing[1]	Self-efficacy	1.32	0.18	0.13	0.93	1.87
	Outcome expectations	2.44	0.27	**<0.001**	1.45	4.11
	Proximal goals	5.01	0.56	**<0.001**	1.66	15.13
Considering[2]	Self-efficacy	1.44	0.13	**<0.01**	1.12	1.84
	Outcome expectations	1.79	0.18	**<0.001**	1.26	2.55
	Proximal goals	1.26	0.11	**<0.05**	1.01	1.57
Contacting[3]	Self-efficacy	1.25	0.17	0.21	0.89	1.75
	Outcome expectations	1.72	0.18	**<0.001**	1.21	2.44
	Proximal goals	1.14	0.04	**<0.001**	1.06	1.24

p: statistically significant predictors indicated in bold font. B, exponential of β (odds ratio); SE, standard error; CI confidence interval.

[1] Cox & Snell R^2 0.14, Nagelkerke R^2 0.24.

[2] Cox & Snell R^2 0.11, Nagelkerke R^2 0.15.

[3] Cox & Snell R^2 0.20, Nagelkerke R^2 0.29.

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